

The Sibsize Revolution in International Context. Declining Social Disparities in the Number of Siblings in 26 Countries*

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Abstract

Background: One's number of siblings is an important determinant for many life outcomes such as educational attainment. The US has experienced a 'sibsize revolution' in the last century, in which sibship sizes declined and which led to a convergence in family circumstances for children. Did this happen in other countries as well? *Objective:* This study examines the development of sibship size and social disparities in sibship size in low-fertility countries across the twentieth century. *Methods:* We analyze sibship size data collected from 111 nationally representative surveys conducted in 26 low-fertility countries across the twentieth century. *Results:* Average sibship sizes have declined

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in virtually all countries. Average sibship sizes are socially stratified, with smaller sibship sizes among higher-educated parents. This social disparity in sibship size has declined over time, indicating convergence in most countries. This convergence takes place for large families, but not for only-child families. *Contribution:* Siblings are an understudied phenomenon in family demography, despite their growing importance in a time of increasingly complex family structures. Given the significance of sibship size for children’s educational outcomes and overall life chances, decreasing social disparities in sibship size suggest greater equality in the intergenerational transmission of advantage.

Introduction

Sibship size, defined as the number of children in a child’s sibling group, is a predictor of many important early and later-life life outcomes, ranging from greater survival chances as infants to greater educational attainment for those with fewer siblings (Björklund and Salvanes 2011; Blau and Duncan 1967; Steelman et al. 2002). Sibship size is crucial for childrens’ access to familial resources and living conditions. Siblings play an important role for the development of children. McHale, Updegraff, and Whiteman (2012) report that in 2010, 82 per cent of US children under the age of 18 years lived with at least one sibling—a percentage that is higher than of those living with a father figure. In times of increasingly complex family structures (Kalmijn et al. 2019), the presence of siblings, including adopted siblings and step-siblings, are a remarkable constant for children’s lives within families. Children spend the majority of their discretionary time in activities with their siblings (Dunifon, Fomby, and Musick 2017). Growing up without siblings goes along with fewer social skills during childhood (Downey, Condron, and Yucel 2015). Siblings also bear importance beyond childhood, as they are typically the longest-lasting family relationship in an individual’s life (Dunifon, Fomby, and Musick 2017).

A change in sibship size, therefore, has important implications about the changing role of family in children’s wellbeing and life chances. Fahey (2017)

has identified declines in sibship sizes in the US since the 1970's, particularly among children of black and lower-educated mothers. The decline in sibship size improved children's living conditions so much, it presumably offsets the negative consequences of the parallel trend of lone parenthood. Fahey suggests that the decline in sibship size amounted to a 'sibsize revolution.' But has this revolution also taken place outside of the US? While social disparities in family size were a prominent area of research in the first half of the twentieth century (Bavel [2010](#); Notestein [1936](#)), the research focus in the second half shifted to family structures, such as out-of-wedlock births, divorce, and lone parenthood (Fahey [2017](#)). To assess whether the sibsize revolution diagnosed by Fahey ([2017](#)) also took place outside of the US, we examine disparities in sibship sizes by parental education in 26 countries across the twentieth century.

Next to changes and socio-economic disparities in *average sibship size*, we also examine the heterogeneity in sibship sizes, focusing on only-children (those without siblings) and children from large families (those with four siblings or more). Scholarly attention to these aspects of family size has been limited, as much of the existing research conceives sibship size effects as being linear in nature, largely overlooking possible non-monotonic patterns. The prevalence of only-children varies considerably across countries (Choi and Monden [2017](#)). Choi and Monden ([2017](#)) show that only-children tend to come from advantaged socioeconomic backgrounds when the share of only-children in a country is high. When only-children are rare in a country, this pattern is reversed: only-children disproportionally come from less advantaged family backgrounds. Is there a trend towards more only-children? And are social disparities in only-child prevalence converging? The changing nature of large families is also an under-researched issue. Research on parity progression in middle and high-income countries focuses primarily on lower order-parities (up to three, e.g. Duvander et al. [2019](#); Köppen and Trappe [2019](#); Nisén et al. [2018](#)) and neglects larger families. However, how socioeconomic disparities of living in a large families have changed, particularly in comparative perspective, has rarely been addressed in prior demographic and sociological research.

In this study, we make use of survey data on sibship size collected from 111 surveys conducted in 26 low-fertility countries over the course of the twentieth century. We are primarily interested in what happens to sibship size and the social stratification of sibship size over time focusing on trends rather than point estimates. We focus on countries that had low fertility, broadly defined as a total fertility rate below 2.1 during the 1990's, when the youngest cohorts in our samples were of school-age. Our sample includes most industrialized countries in Europe, North America, Australia, and East Asia as well as many post-communist countries. We excluded countries in other regions (e.g. Latin America, South and Southeast Asia, Africa) that were either less developed or developing during the 1990's. We include some countries that transitioned to low fertility status relatively recently, such as some East Asian and post-communist countries.

In a first step, we describe the development of average sibship sizes as well as the prevalence of only-children and large families, respectively, over the twentieth century. In a second step, we compare social disparities in average sibship sizes, the prevalence of only-children, and the prevalence of large families. We assess social disparities by comparing outcomes by parental education. In a third step, we examine disparities in sibship size distinguishing between paternal and maternal education. In an important study on Nordic countries, Jalovaara et al. (2019) found gender differences in educational disparities of both cohort fertility and childlessness. Our data allow us to assess differences by parental gender in average sibship sizes for a wider range of countries.

Our study makes three contributions to the existing literature. First, our descriptive account of sibship size over time and across countries is key for understanding the living conditions of children. McHale, Updegraff, and Whiteman (2012) admonished the lack of research on siblings in family demography and called for greater efforts to incorporate sibling relationships into research. Second, rather than just focusing on the average sibship size, we incorporate a wider range of family size indicators—only-children and large families—to better grasp the development of family size over time. Finally,

our study adds to the growing body of interdisciplinary stratification research that seeks to incorporate intergenerational reproduction and demographic processes (Breen, Ermisch, and Helske 2019; Grätz et al. 2019; Song and Campbell 2017).

Sibship size in the intergenerational transmission of inequalities

Sibship size has long been seen as an important factor predicting many child outcomes, such as survival, education, earnings, and occupational attainment (Steelman et al. 2002). Blake (1981) suggested that growing up in a large family makes it more difficult to access material and non-material family resources, such as living space and books, trips to the museum and family vacations, or parental attention and intervention. Given that these resources are important inputs for children’s developmental outcomes, children are expected to have on average worse educational outcomes as they share family resources more with siblings. This ‘resource dilution’ model of child development has found much support in empirical research (see e.g. Gibbs, Workman, and Downey 2016; Workman 2016 for references).

Much of the existing research on sibship size effects is correlational rather than causal in nature (Choi et al. 2020). Parental characteristics, for instance, could affect both family size and child wellbeing. As these parental characteristics, such as preferences, self-control, or planning abilities are usually unobserved, the association between family size and child outcomes are likely upwardly biased due to this confounding. Existing causal evidence on sibship size effects points in that direction. Some studies such as Black, Devereux, and Salvanes (2005) and Angrist, Lavy, and Schlosser (2010) make use of the sex composition of children and twinning as instrumental variables to account for unobserved confounding, and do not find consistent support for a causal sibship size effect on education. Similarly designed studies, such as Conley and Glauber (2006), Ferrari and Dalla-Zuanna (2010), and Blaabæk, Jæger, and Molitoris (2020), find that only part of the negative association between

sibship size and education is causal in a number of settings.

Family size is not only related to educational attainment, but is also related to other important living conditions and outcomes in child development, both material as well as non-material, such as housing conditions on the one hand, and sibling rivalry, reaction to stress, and learning leadership and cooperation on the other (Ernst and Angst 1983; McHale, Updegraff, and Whiteman 2012; Zajonc and Markus 1975). Sibling interactions are believed to be useful for developing social skills and relations with peers (Whiteman, McHale, and Soli 2011), and having fewer siblings—or no siblings at all—can have grave behavioral consequences (Downey, Condrón, and Yucel 2015). For instance, Cameron et al. (2013) describe Chinese only-children as less trusting, less trustworthy, more risk-averse, less competitive, more pessimistic, and less conscientious than their counterparts who have siblings.

But sibship size is not only an antecedent of social inequalities, sibship size itself is also a socially stratified phenomenon. Empirical research has long been occupied with studying fertility differentials between the rich and the poor (e.g. Dribe, Oris, and Pozzi 2014; Sobotka 2017). In contemporary societies, education often stands in the way of childbearing (and vice versa) (Balbo, Billari, and Mills 2013), leaving families of higher-educated parents often smaller than those of their lower-educated counterparts, creating essentially a ‘two-tier family structure’ for children (Putnam 2015). Coming from a lower-educated family background, children often have to compete with more siblings for fewer resources than the children of higher-educated parents, potentially creating a downward spiral for those at the bottom of the educational distribution.

This disparity has not always existed in this form (Skirbekk 2008). For instance, Clark (2007) prominently argued that higher fertility among the British upper class was an important driver of the Industrial Revolution. Yet, under conditions where out-of-wedlock births were rare and frowned upon, this comparably high fertility among those of high social status partially stems from status differences in the timing of marriage and the proportion

remaining unmarried (Hajnal 1965). Those of higher status married younger and thus had more time to have children, those of lower status often remained unmarried and childless. Thus, the focus on fertility, family size as seen from the mother’s perspective, rather than sibship size, the perspective of the children, gives limited insights into sibship size and the actual living conditions of children growing up.

In sum, sibship size can be expected to be a major linchpin in the intergenerational transmission of inequalities, as it does not only serve as a predictor, but also as a consequence of lower education.

Data and methods

For our analyses, we have harmonized data from 111 national surveys collected in 26 countries. We have made these data publicly available as the International Sibsize and Educational Attainment Database (ISEAD, Monden et al. 2018). For creating ISEAD, we used the following criteria in the selection of surveys. First, we only utilized surveys from countries broadly defined as having low fertility at the end of the twentieth century. Our data include countries in Europe (Western and Eastern, including the former Soviet Union), North America and Australia, and East Asia. Second, a survey had to be nationally representative of the adult population. We excluded studies surveying exclusively young children and adolescents because of a concern that the number of siblings may increase as respondents’ parents might have more children in the future. Third, a survey had to contain all the information about a respondent necessary for our analysis, such as the number of siblings, parental educational attainment (the highest one between father’s and mother’s or father’s if mother’s education is unavailable), as well as basic demographic characteristics (e.g. age at the time of survey or year of birth, and sex). We excluded surveys containing incomplete information on sibship size. For example, we excluded several household-based surveys that only provided information on siblings living in the same household. Fourth, we only used surveys that covered at least 500 individuals.

Table 1: List of survey datasets in Monden et al. (2018) with information on sex composition, age/cohort, and missing observations¹

Country	Data set	Year	% female	Age range	Birth cohort range	<i>N</i> full	<i>N</i> cohort restriction	<i>N</i> parental education	<i>N</i> maternal education
Australia	International Social Survey Program (ISSP Research Group 1988)	1986	52.1	18–84	1902–68	2,500	2,156	–	–
Australia	Generations and Gender Program (Vikat et al. 2007)	2005	55.4	18–98	1906–87	7,125	6,871	6,129	5,705
Belgium	Generations and Gender Program (Vikat et al. 2007)	2008	52.0	18–82	1928–90	7,163	7,019	6,525	6,342
Bulgaria	Social Stratification in Eastern Europe (Szelényi and Treiman 2017)	1993	51.7	19–78	1915–74	4,919	4,652	4,577	4,488
Bulgaria	Generations and Gender Program (Vikat et al. 2007)	2004	54.5	18–85	1919–86	12,858	12,206	11,726	11,560
Canada	Class Structure and Class Consciousness Survey (Wright 1990)	1982	48.2	18–80	1902–64	2,577	2,554	1,162	1,120
Canada	Canadian General Social Survey (Statistics Canada 1995)	1995	55.0	18–80	1915–77	10,749	10,303	9,075	8,545

¹“*N* full” states the sample size of the entire survey data set, “*N* cohort restriction” is the sample size after removing cases which were from birth cohorts before 1900 and cases with missing information about sibship size or birth year, “*N* parental education” additionally removes cases where no information about the education of either parent was available. “*N* maternal education” removes all cases where no information about maternal education was available. (The sample sizes for cases with missing paternal education is not shown, as it is almost identical to “*N* parental education.”)

Country	Data set	Year	% female	Age range	Birth cohort range	<i>N</i> full	<i>N</i> cohort restriction	<i>N</i> parental education	<i>N</i> maternal education
Canada	Canadian General Social Survey (Statistics Canada 2000)	2000	56.1	18–80	1920–82	24,310	23,454	20,167	18,949
China	China Housing Survey (Logan and Bian 2000)	1993	39.7	18–67	1931–80	2,096	1,857	1,108	993
China	East Asian Social Survey (Kim et al. 2014)	2006	54.7	18–69	1937–88	3,208	3,206	3,202	3,200
China	China Family Panel Studies (Xie et al. 2016)	2010	51.7	20–79	1931–90	31,731	30,965	27,674	26,950
Czechia	Social Stratification in Eastern Europe (Szelényi and Treiman 2017)	1993	55.0	20–70	1923–73	5,621	5,579	5,500	5,409
Czechia	Generations and Gender Program (Vikat et al. 2007)	2005	52.1	18–79	1926–87	10,006	9,939	9,305	9,211
East Germany	German Socio-Economic Panel (Schupp et al. 2017)	1984–2015	52.3	18–95	1902–90	14,730	9,260	8,652	8,322
East Germany	Generations and Gender Program (Vikat et al. 2007)	2005	57.0	18–85	1920–87	1,766	1,736	1,661	1,659
Estonia	Generations and Gender Program (Vikat et al. 2007)	2005	64.1	20–81	1924–83	7,855	7,290	7,278	7,275
France	Training and Qualifying Survey Professional (INSEE 1985)	1985	42.7	18–84	1901–67	39,233	38,446	38,005	37,528
France	Training and Qualifying Survey Professional (INSEE 1993)	1993	50.7	20–64	1929–73	18,332	17,986	17,814	17,634
France	Training and Qualifying Survey Professional (INSEE 2003)	2003	52.8	18–65	1938–85	39,285	39,285	39,026	38,830

Country	Data set	Year	% female	Age range	Birth cohort range	<i>N</i> full	<i>N</i> cohort restriction	<i>N</i> parental education	<i>N</i> maternal education
France	Generations and Gender Program (Vikat et al. 2007)	2005	56.6	18–79	1926–87	10,079	10,039	8,983	8,631
Georgia	Generations and Gender Program (Vikat et al. 2007)	2006	55.9	18–80	1926–88	10,000	9,547	9,101	8,959
Hungary	International Social Survey Program (ISSP Research Group 1988)	1986	55.9	18–85	1901–68	1,747	1,626	–	–
Hungary	Social Stratification in Eastern Europe (Szelényi and Treiman 2017)	1993	53.4	18–92	1901–75	4,977	4,418	–	–
Hungary	Generations and Gender Program (Vikat et al. 2007)	2004	55.5	20–79	1926–83	13,540	13,505	13,353	13,282
Italy	Generations and Gender Program (Vikat et al. 2007)	2003	53.4	18–64	1939–85	9,570	9,570	9,366	9,338
Japan	Japanese Social Stratification and Mobility (SSM Survey Management Committee 2011a)	1995	53.5	20–70	1925–75	5,357	5,351	4,985	4,545
Japan	Japanese General Social Survey (Tanioka, Iwai, et al. 2007a)	2000	54.4	20–89	1911–80	2,893	2,792	2,374	2,317
Japan	National Survey on Family and Economic Conditions (Tsuya et al. 2009)	2000	53.1	20–50	1950–80	4,482	3,357	–	–
Japan	Japanese General Social Survey (Tanioka, Iwai, et al. 2007b)	2001	54.0	20–89	1912–81	2,790	2,653	2,229	2,180

Country	Data set	Year	% female	Age range	Birth cohort range	<i>N</i> full	<i>N</i> cohort restriction	<i>N</i> parental education	<i>N</i> maternal education
Japan	Japanese General Social Survey (Tanioka, Iwai, et al. 2007c)	2002	53.7	20–89	1913–82	2,953	2,882	2,449	2,401
Japan	Japanese General Social Survey (Tanioka, Nitta, et al. 2007)	2005	54.5	20–89	1916–85	2,023	1,997	1,553	1,529
Japan	Japanese Social Stratification and Mobility (SSM Survey Management Committee 2011b)	2005	53.7	20–70	1935–85	5,742	5,726	4,781	4,572
Japan	East Asian Social Survey (Kim et al. 2014)	2006	54.7	20–89	1917–86	2,130	2,097	1,665	1,613
Japan	Japanese General Social Survey (Tanioka et al. 2010)	2006	53.3	20–89	1917–86	4,254	4,192	3,349	3,246
Japan	Japanese General Social Survey (Tanioka et al. 2015)	2008	52.9	20–89	—	4,220	4,204	3,491	3,404
Japan	National Family Research of Japan (Inaba 2015)	2008	52.9	28–73	1935–80	5,203	5,115	4,327	4,202
Japan	National Survey on Family and Economic Conditions (Choe et al. 2013)	2009	53.0	20–49	1960–89	3,112	2,632	2,463	2,406
Japan	Japanese General Social Survey (Tanioka, Maeda, and Iwai 2015)	2010	54.0	20–89	1921–90	5,003	4,975	4,103	4,018
Japan	Japanese General Social Survey (Tanioka, Iwai, and Maeda 2016)	2012	54.0	22–89	1923–90	4,667	4,566	3,700	3,584
Lithuania	Generations and Gender Program (Vikat et al. 2007)	2006	50.2	18–79	1926–88	10,036	9,543	8,544	8,329

Country	Data set	Year	% female	Age range	Birth cohort range	<i>N</i> full	<i>N</i> cohort restriction	<i>N</i> parental education	<i>N</i> maternal education
Nether- lands	Family Survey Dutch Population (Ganzeboom and Ultee 1993)	1992	51.1	18–78	1914–74	1,801	1,790	1,786	1,764
Nether- lands	Family Survey Dutch Population (De Graaf et al. 1998)	1998	50.7	18–83	1915–80	2,029	2,027	2,004	1,992
Nether- lands	Family Survey Dutch Population (De Graaf et al. 2000)	2000	50.1	18–84	1916–82	1,561	1,539	1,530	1,511
Nether- lands	Family Survey Dutch Population (De Graaf et al. 2004)	2003	58.1	18–80	1923–85	8,161	7,875	7,137	6,979
Nether- lands	Generations and Gender Program (Vikat et al. 2007)	2003	51.1	18–79	1924–85	2,174	2,123	2,083	2,042
Norway	Generations and Gender Program (Vikat et al. 2007)	2007	50.7	18–81	1927–88	14,880	13,876	13,631	13,538
Poland	Polish Panel Survey (Słomczynski et al. 2008)	1988	53.9	19–68	1920–69	5,817	1,888	1,855	–
Poland	Social Stratification in Eastern Europe (Szelényi and Treiman 2017)	1993	52.3	19–77	1916–74	3,520	3,439	3,383	3,317
Poland	Polish General Social Survey (Cichomski, Jerzynski, and Zielinski 2007)	1997	56.2	18–92	1905–79	2,401	1,134	1,101	1,065
Poland	Polish General Social Survey (Cichomski, Jerzynski, and Zielinski 2007)	1999	56.9	18–94	1905–81	2,282	2,200	2,158	2,115

Country	Data set	Year	% female	Age range	Birth cohort range	<i>N</i> full	<i>N</i> cohort restriction	<i>N</i> parental education	<i>N</i> maternal education
Poland	Polish General Social Survey (Cichomski, Jerzynski, and Zielinski 2007)	2002	57.6	18–94	1908–84	2,473	2,410	2,395	2,354
Poland	Generations and Gender Program (Vikat et al. 2007)	2010	57.9	19–83	1927–90	19,987	18,550	17,473	17,207
Romania	Generations and Gender Program (Vikat et al. 2007)	2005	50.1	18–80	1925–87	11,986	11,986	11,759	11,588
Russia	Russian General Social Survey (Swafford et al. 2006)	1992	55.3	18–89	1903–74	2,149	1,948	–	–
Russia	Social Stratification in Eastern Europe (Szelényi and Treiman 2017)	1993	59.9	18–89	1904–75	5,002	4,364	4,301	4,246
Russia	Generations and Gender Program (Vikat et al. 2007)	2004	62.5	18–81	1923–86	11,261	10,989	9,522	8,988
South Korea	Inequality and Equity Survey (Whang et al. 2004)	1990	20.2	18–83	1907–72	1,974	1,846	1,843	1,841
South Korea	Korean General Social Survey (Kim 2014)	2004	53.4	18–93	1911–86	1,312	1,260	1,195	1,178
South Korea	Korean General Social Survey (Kim et al. 2014)	2006	55.5	18–92	1914–88	1,605	1,551	1,469	1,426
South Korea	Education and Social Mobility Survey (Park 2011)	2009	49.4	25–65	1943–86	7,616	7,610	7,454	7,396
Spain	Occupational Prestige and Social Structure (CIS 2013)	2013	51.0	23–99	1914–90	5,962	5,271	5,195	5,160
Sweden	Generations and Gender Program (Vikat et al. 2007)	2012	51.5	21–80	1933–90	9,688	8,964	8,319	7,930
Taiwan	Taiwan Social Change Survey (Chiu 1999)	1997	52.6	20–64	1933–77	1,717	1,717	1,681	1,665

Country	Data set	Year	% female	Age range	Birth cohort range	N full	N cohort restriction	N parental education	N maternal education
Taiwan	Panel Study of Chinese Family Dynamics (Chu 2002)	1999	54.8	36–46	1953–63	999	995	973	961
Taiwan	Taiwan Social Change Survey (Chang 2002)	2001	49.5	21–93	1902–74	1,979	1,870	1,828	1,817
Taiwan	Taiwan Social Change Survey (Chang 2014)	2004	48.6	19–98	1906–85	1,781	1,755	1,705	1,693
Taiwan	East Asian Social Survey (Kim et al. 2014)	2006	49.8	19–92	1903–76	2,102	1,974	1,948	1,936
Taiwan	Taiwan Social Change Survey (Chang 2016)	2012	49.7	22–101	1911–90	2,134	2,001	1,928	1,880
Taiwan	Taiwan Social Change Survey (Fu 2015)	2014	50.2	24–97	1917–90	1,875	1,695	1,643	1,615
Taiwan	Taiwan Social Change Survey (Fu 2017)	2015	48.8	25–94	1921–90	2,034	1,809	1,744	1,716
USA	Growth of American Families (Freedman, Campbell, and Whelpton 2009)	1955	100.0	18–54	1901–37	2,713	2,661	–	–
USA	General Social Survey (Smith, Hout, and Marsden 2016)	1972–2014	55.9	18–89	1901–90	59,599	56,675	50,816	47,732
United Kingdom	Oxford Social Mobility Inquiry (Oxford Social Mobility Group et al. 1978)	1972	0.0	20–64	1902–53	10,309	10,309	9,784	8,650
United Kingdom	National Heights and Weights Survey (Office of Population Censuses and Surveys 1985)	1980	51.3	18–79	1901–64	10,363	9,377	–	–

Country	Data set	Year	% female	Age range	Birth cohort range	<i>N</i> full	<i>N</i> cohort restriction	<i>N</i> parental education	<i>N</i> maternal education
United Kingdom	International Social Survey Program (ISSP Research Group 1988)	1986	53.0	18–85	1901–68	1,416	1,395	–	–
United Kingdom	UK National Survey of Sexual Attitudes and Life Style (Field et al. 1995)	1990	56.6	18–59	1931–72	4,548	4,371	–	–
United Kingdom	UK National Survey of Sexual Attitudes and Life Style (National Centre for Social Research et al. 2005)	2000	57.3	18–44	1955–83	12,110	11,427	–	–
United Kingdom	UK Household Longitudinal Study (University of Essex, Institute for Social and Economic Research, and NatCen Social Research 2016)	2009	57.9	18–58	1951–90	7,304	6,860	6,860	6,667
United Kingdom	UK National Survey of Sexual Attitudes and Life Style (Johnson et al. 2015)	2010	58.5	19–74	1935–90	15,162	13,035	–	–
West Germany	International Social Survey Program (ISSP Research Group 1988)	1986	53.6	18–85	1901–68	2,809	2,616	–	–
West Germany	German Socio-Economic Panel (Schupp et al. 2017)	1990–2015	52.2	18–99	1901–90	61,140	36,108	32,507	30,120
West Germany	Generations and Gender Program (Vikat et al. 2007)	2005	53.5	18–80	1925–87	7,760	7,613	7,395	7,366

Table 1 lists the surveys included in our analyses, stating sample size as well as age and birth cohort ranges of respondents. More comprehensive and general information, as well as files for data-processing and macro-level data sets generated from the ISEAD, are available in Monden et al. (2018). We limit our sample to individuals who were at least 18 years old at the time of the survey. Because we take a cohort-based approach, we pooled all national surveys of each country and divided each pooled national sample into nine ten-year-wide birth cohorts that cover the twentieth century: from those born between 1901 and 1910 to those born between 1981 and 1990. For a robust estimation, we only used country-cohort samples with at least 500 observations.² Taking into account these sample restrictions, the final data we used included 636,454 adult individuals from 179 country-cohort samples, as shown in Table 2.

Table 2: Observations by birth cohort and country from the International Sibsize and Educational Attainment Database (ISEAD, Monden et al. 2018)

	1901-10	1911-20	1921-30	1931-40	1941-50	1951-60	1961-70	1971-80	1981-90	Total
Australia	0	0	873	1,042	1,443	1,931	1,882	1,165	691	9,027
Belgium	0	0	0	756	1,065	1,405	1,508	1,226	1,059	7,019
Bulgaria	0	0	1,072	2,212	2,699	2,677	3,776	2,966	1,456	16,858
Canada	0	1,784	3,430	4,156	6,100	7,786	7,719	4,696	640	36,311
China	0	0	0	2,645	5,389	7,419	8,842	6,631	5,102	36,028
Taiwan	0	0	597	1,231	1,905	3,601	3,108	2,072	1,302	13,816
Czechia	0	0	1,504	2,114	2,885	2,927	2,627	2,204	1,257	15,518
Estonia	0	0	549	1,184	1,252	1,465	1,403	1,437	0	7,290
France	0	1,399	5,877	13,122	22,579	26,060	22,156	10,370	4,193	105,756
Georgia	0	0	0	1,280	1,200	1,903	2,022	1,830	1,312	9,547
East Germany	0	0	509	1,458	1,568	2,083	2,291	1,894	1,193	10,996
West Germany	0	539	2,369	5,010	6,147	7,709	10,790	8,516	5,257	46,337
Hungary	0	0	1,522	2,746	3,604	4,272	3,276	3,303	826	19,549
Italy	0	0	0	595	2,221	2,199	2,467	1,519	569	9,570
Japan	0	0	2,739	7,284	10,732	9,819	9,688	9,363	2,914	52,539
South Korea	0	0	0	696	1,654	2,732	3,349	2,432	1,404	12,267
Lithuania	0	0	0	1,547	1,413	1,712	1,798	1,596	1,477	9,543
Netherlands	0	0	724	1,939	2,983	3,679	3,948	2,081	0	15,354
Norway	0	0	0	1,557	2,500	2,510	2,945	2,543	1,821	13,876
Poland	0	0	1,238	4,301	5,475	6,778	4,579	4,390	2,860	29,621
Romania	0	0	695	1,946	2,085	2,368	2,264	1,822	806	11,986
Russia	0	0	1,558	2,710	2,575	3,807	3,310	2,398	943	17,301
Spain	0	0	0	495	739	815	1,051	1,186	985	5,271
Sweden	0	0	0	767	1,729	1,633	1,783	1,599	1,453	8,964
United Kingdom	813	3,198	4,394	5,668	7,874	9,469	10,736	8,334	6,288	56,774
USA	2,336	5,361	7,275	6,963	10,224	11,984	8,352	4,750	2,091	59,336
Total	3,149	12,281	36,925	75,424	110,040	130,743	127,670	92,323	47,899	636,454

²With one exception, the Spanish 1931–40 birth cohort only has 495 observations.

Sibship size is the total number of brothers and sisters a respondent has ever had, including the respondent herself. Many surveys did not specify whether respondents should count half- or non-biological siblings such as step-siblings and adopted siblings, while others clarified that siblings should include the number of full, half, and non-biological siblings. Since we did not identify any single survey that asked for the number of biological siblings specifically, we assumed that all values of the number of siblings represented sibship size inclusive of all types of siblings. To minimize an arbitrary variation in the upper bound of sibship size across surveys, we use the value 11 for all sibship size values higher than 10.

Parental education is measured as a binary variable, indicating whether at least one parent holds a tertiary degree. This variable usually refers to the persons the respondent identifies as their father and mother; most surveys do not specify who this should be, but it is most likely the social parent the respondent grew up with. We converted the original measurements of parental education into the ISCED classification (with ISCED groups 5 and 6 indicating tertiary education, UNESCO 2006) and relied on the so-called ‘dominance’ approach (Erikson 1984) for creating our final variable, i.e. substituting father’s education with mother’s education if father’s education is missing or lower than mother’s education. We draw on parental education—rather than occupation, income, or social class—as a measure of socioeconomic status for several reasons (Präg and Subramanian 2017). Firstly, education reflects both parental material and non-material resources and social status in a broad fashion. Secondly, the ISCED, with its high degree of cross-national standardization, allows to meaningfully compare educational groups across countries. Thirdly, educational attainment is usually completed in early adulthood and remains for the most part stable across the life course, unlike income or occupation. Fourthly, compared to income, which usually comes with a large proportion of non-respondents, education is a comparably easy-to-measure indicator of socioeconomic status. Finally, education is a meaningful measure for the socioeconomic status of both men and women and for those outside of the labor force.

Only-children are respondents who report not having any siblings. Respondents are considered to be from *large families* when they report having four or more siblings, i.e. report a sibship size of five and more.

Assessment of trends over time

Divergence or convergence in demographic disparities by parental background are calculated separately for each country as simple ordinary least squares regression model. For each country and birth year of respondents, we calculate the disparity between parents with and without a degree and regress this disparity on the respondents' birth years:

$$M_{loeduc} - M_{hieduc} = a + b \times X_{birthyear} + \epsilon$$

where M_{loeduc} and M_{hieduc} are the average sibship sizes (or the prevalence of only-children or large families) per country and birth year for higher and lower-educated parents. The coefficient b (as shown in Figures 4, 6, 8, and 11) indicates the trend of the gap in sibship size between the groups of children with different parental education levels: convergence when negative or divergence when positive. For instance, for the analysis of average sibship sizes, b can thus be interpreted as the the annual rate of change in the average gap between parents with a tertiary degree and parents without such a degree.

To address possible non-linearities in the trends over time, we also fitted a second model where we added a quadratic term $c \times X_{birthyear}^2$. Countries with (inverted) U-shaped developments (i.e. where the coefficient c was significantly different from 0) are excluded from further analyses.

Replicability

The data used for our analyses is publicly available. Details about the data used can be found in Monden et al. (2018). For replicating the analyses presented in this manuscript, we provide a set of Stata and R files on-line (Präg, Choi, and Monden 2020).

Results

Average sibship size, prevalence of only-children, and prevalence of large families over time

Figure 1 presents the average sibship size over time for 26 countries. Across the board, average sibship sizes have decreased for birth cohorts over the twentieth century. Reductions have often been considerable, for instance from almost six in the oldest to around two in the most recent birth cohort in Canada. But this pattern is not without exceptions, in Germany average sibship size remained relatively stable over the observation period.

Figure 2 shows the prevalence of only-children and large families (i.e. sibship sizes of five and above) over time for 26 countries. For large families, there has been a decrease in all countries, and similar to average sibship size, the reduction has often been large. For instance, in the US the percentage of respondent from large families has dropped from more than sixty per cent for those born at the beginning of the last century to about thirty per cent for those born at the end. For only-children, change has been more modest. Apart from China with its marked increase in only-children from 13 per cent for those in the 1930's to almost fifty per cent among those from the 1980's, few countries show strong variation over time.

Disparities in sibship size

Figure 3 stratifies average sibsize by parental education. In all countries, children of parents without a tertiary degree have on average more siblings than children of parents with a tertiary degree. The size of this difference varies over time. For instance, in the most recent US birth cohort, we find 4.4 siblings in a lower-educated family and 3.6 siblings in higher-educated families, a difference of almost an entire child. In Norway, however, the sibship size from higher-educated parents is on average 2.9 and among their lower-educated counterparts 3.0—a miniscule difference. In some cases, such as China, Romania, and Spain, confidence intervals overlap at some time

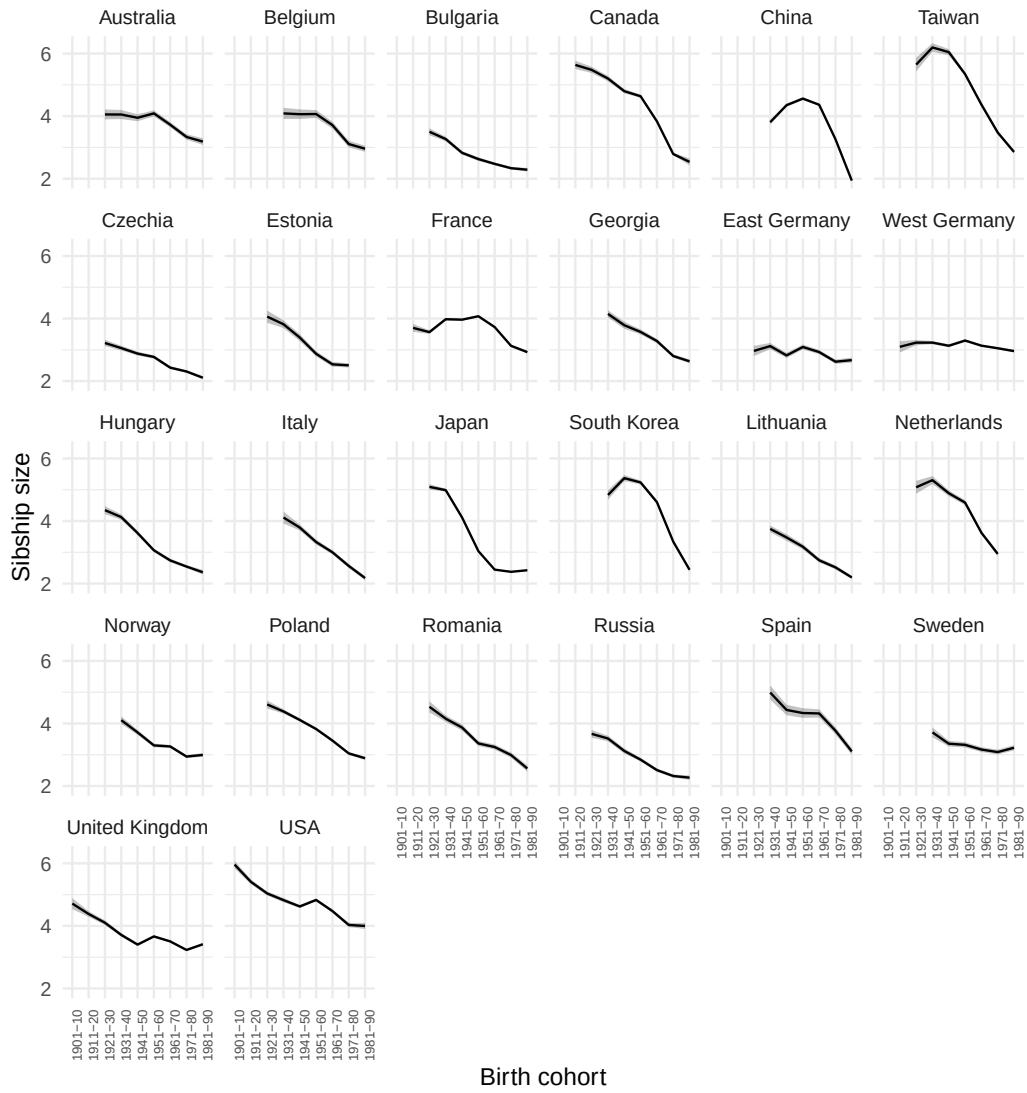


Figure 1: Average sibship size in 26 countries, 1901–90 birth cohorts, $N = 636,454$. Error bands denote 95 percent confidence intervals. *Source:* ISEAD (Monden et al. 2018), own calculations.

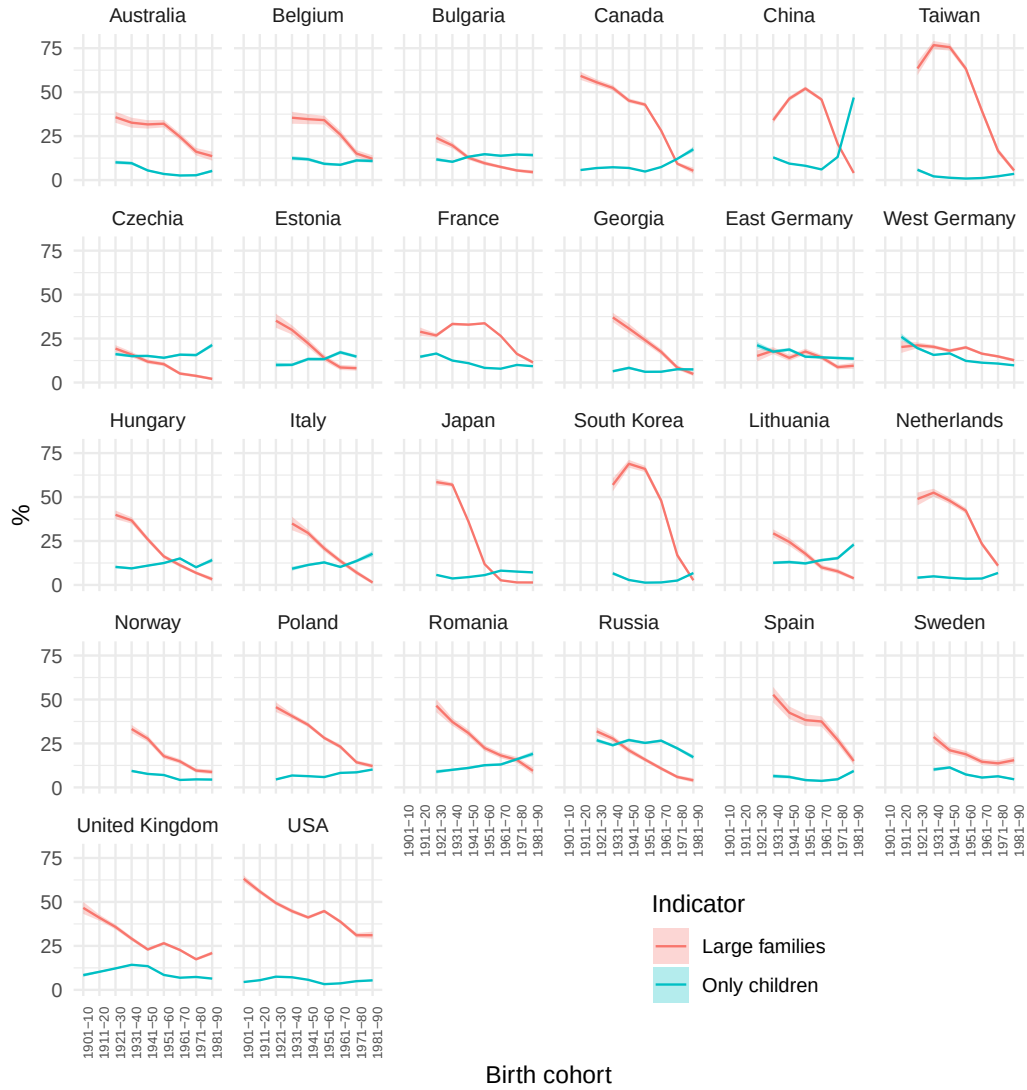


Figure 2: Prevalence of only-children and large families (sibships of 5 and more) in 26 countries, 1901–90 birth cohorts, $N = 636,454$. Error bands denote 95% confidence intervals. *Source:* ISEAD (Monden et al. 2018), own calculations.

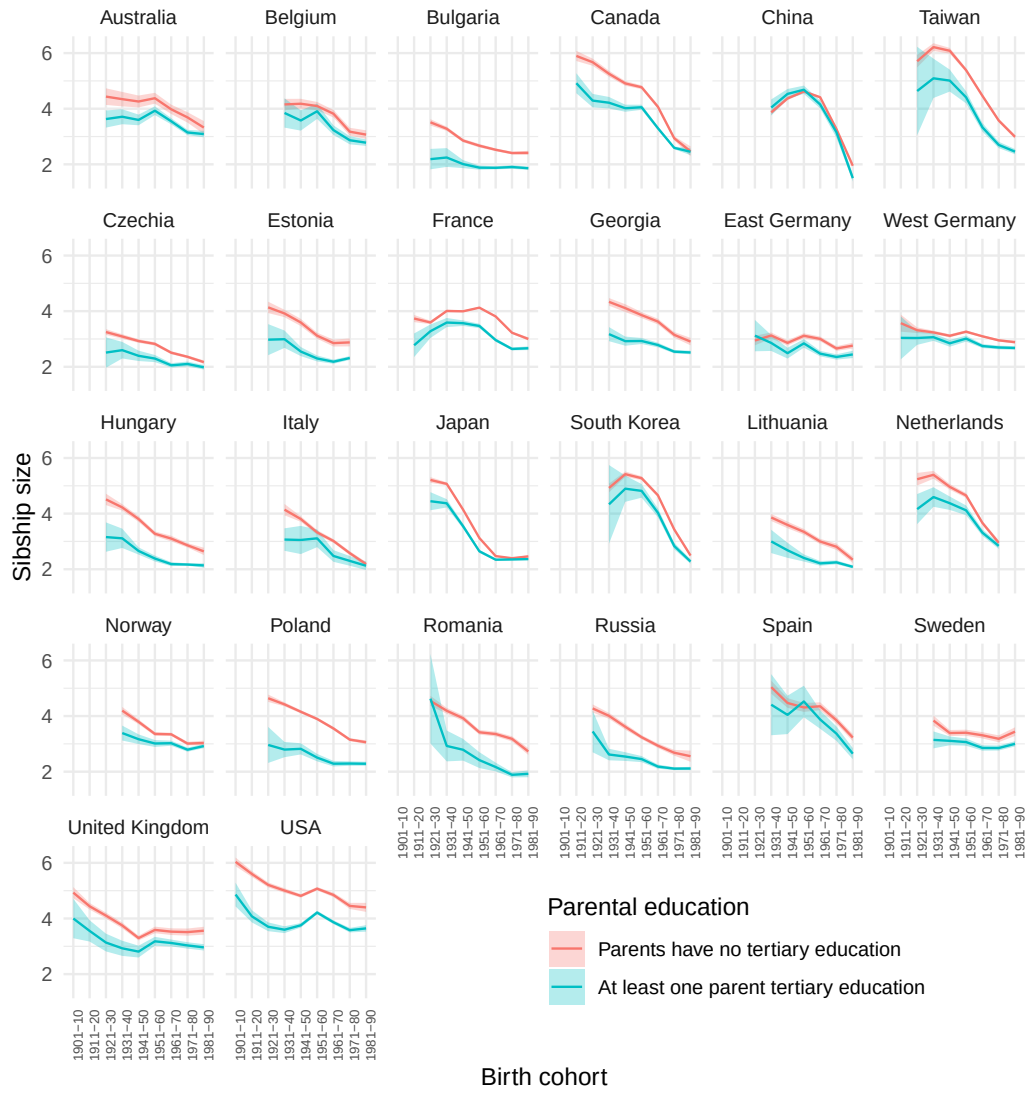


Figure 3: Sibship size by parental education in 26 countries, 1901–90 birth cohorts, $N = 537,807$. Error bands denote 95% confidence intervals. *Source:* ISEAD (Monden et al. 2018), own calculations.

points, indicating that the null hypothesis of no difference between higher and lower-educated parents cannot be rejected at conventional levels of statistical precision. The gaps tend to be greater in some countries than in others. Eastern European countries have relatively a large gap in sibship size between those of high-educated parents and those of low-educated parents. Another noticeable pattern is a narrowing trend of the disparity by parental degree in the majority of countries. Only a few countries show a widening gap. We further observe a two-phase pattern in a number of countries, such as Italy or the United Kingdom, where convergence took place among birth cohorts before the 1940's and have been followed by a period of relative stability. Further comparisons by region show no discernible patterns.

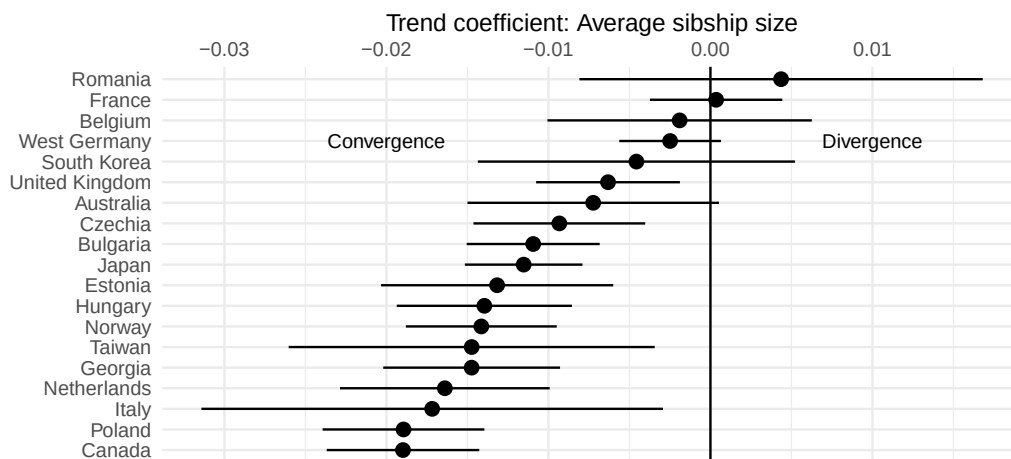


Figure 4: Convergence and divergence of large family prevalence by parental education in 19 countries, 1901–90 birth cohorts. Countries with non-linear trends excluded. Error bars indicate 95 per cent confidence intervals. *Source*: ISEAD (Monden et al. 2018), own calculations.

Figure 4 assesses the convergence between higher and lower-educated families over time more formally. The trend coefficient indicates whether the gap between higher and lower-educated families closes over time—convergence—or widens, which indicates divergence. For instance, in Poland the average sibship size gap of children from higher and lower-educated parents reduced by 0.02 per year, which equates to one child over a fifty-year period. Figure 4 confirms that virtually all countries have experienced a convergence in sibship

sizes. In only two countries—France and Romania—we detect a diverging trend, but both of these are not statistically significant at the conventional level.

In sum, our analyses show that children of lower-educated parents grow up with more siblings than those of higher-educated parents and that, however, this disparity has declined over time in virtually all countries in our study.

Disparities in growing up as an only-child

Figure 5 shows the prevalence of only-children by parental education. First, there is less social disparity when it comes to only-children. In more than half of the countries, there is no difference in prevalence between the lower and the higher-educated. Second, however, we find an important regional difference in the countries under study. In the Eastern European countries, there is a marked social disparity in the prevalence of only-children—Bulgaria, Estonia, Hungary, Poland, Romania, and Russia. In these countries, prevalence rates are higher among the higher educated. For instance, in Poland, the prevalence rate of only-children in the latest cohort is 7.8 per cent among those with lower-educated and 17.2 per cent among those with higher-educated parents. Third, when it comes to the changes in the disparity, there is no clear trend to be found (Figure 6). The majority of countries show a widening gap, but most of the growth is not statistically significant—except in the United States, Canada, Georgia and Estonia.

Disparities in growing up in large families

Figure 7 shows the percentage of children growing up in a large family by parental education. Large families are those with five children or more. First, we see a declining trend for large family prevalence over time. For instance, in Georgia the prevalence of children from large families fell from 41.1 per cent among the lower educated in the 1930's to 7.8 per cent in the 1980's, the latest cohort, and for the higher educated from 19.2 per cent to 3.8 per cent over the same period of time, a decrease of more than three quarters.

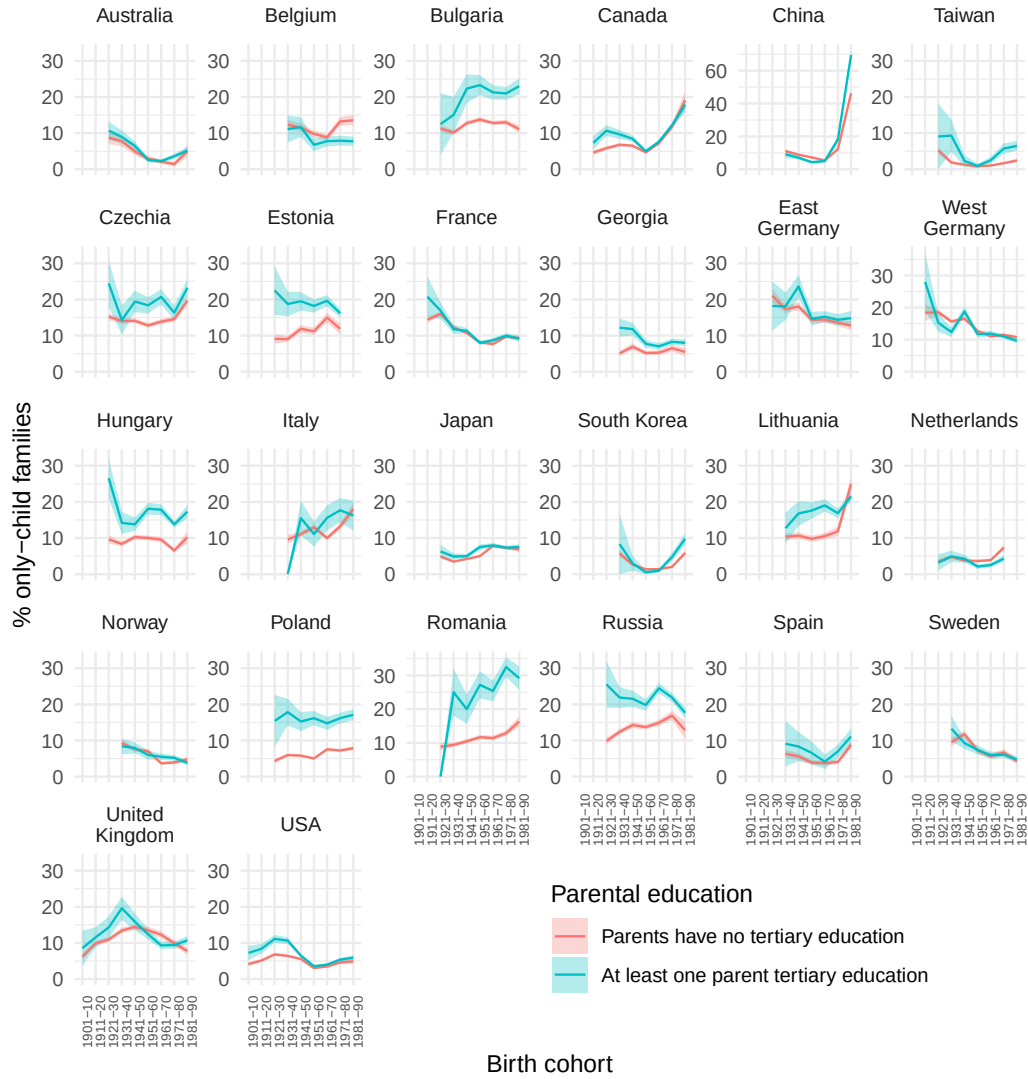


Figure 5: Only-children by parental education in 26 countries, 1901–90 birth cohorts, $N = 537,807$. Error bands denote 95% confidence intervals. China plotted on a different y-axis scale to facilitate comparisons of other countries. *Source:* ISEAD (Monden et al. 2018), own calculations.

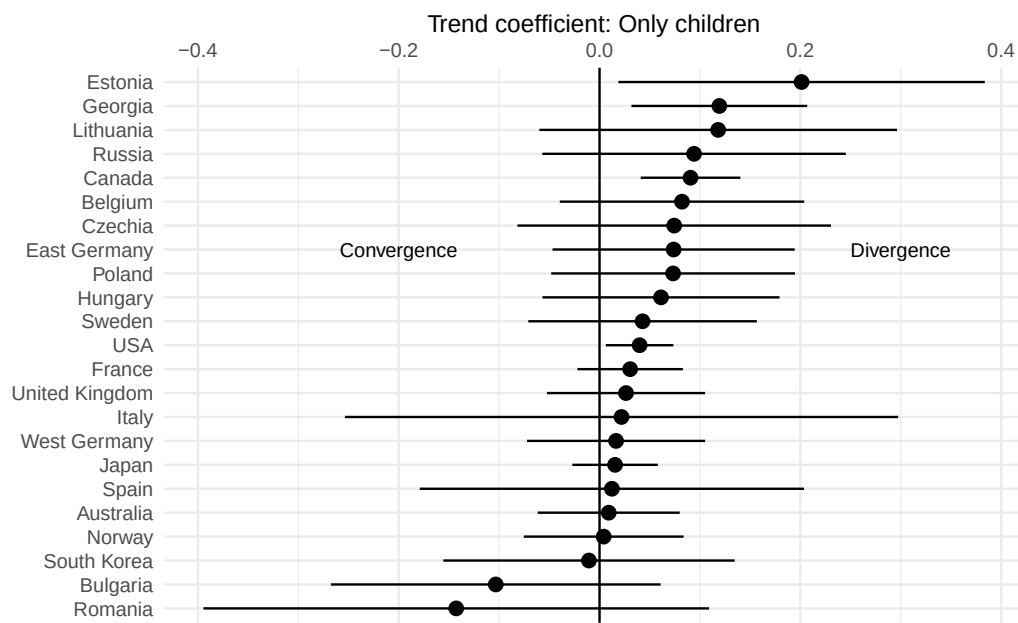


Figure 6: Convergence and divergence of only-children prevalence by parental education in 23 countries, 1901–90 birth cohorts. Countries with non-linear trends excluded. Error bars indicate 95 per cent confidence intervals. *Source:* ISEAD (Monden et al. 2018), own calculations.

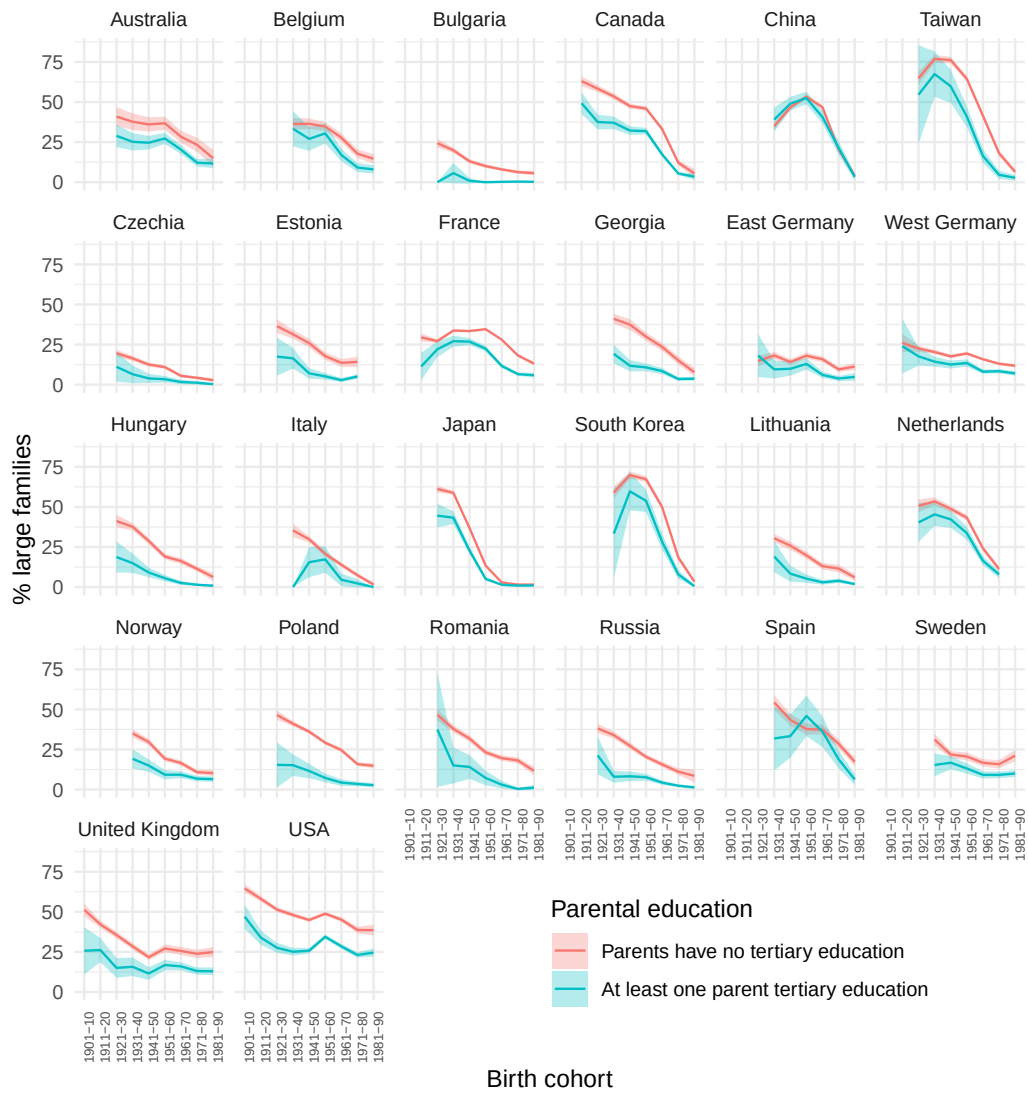


Figure 7: Large families by parental education in 26 countries, 1901–90 birth cohorts, $N = 537,807$. Error bands denote 95% confidence intervals. *Source:* ISEAD (Monden et al. 2018), own calculations.

Secondly, we see that across all countries, children of lower-educated parents are more likely to live in large families, with differences in prevalence rates often around ten per cent. For instance, in the youngest US cohort (1981–1990), 24.6 per cent of respondents from higher-educated parents grew up in large families and 38.6 per cent of respondents from lower-educated parents.

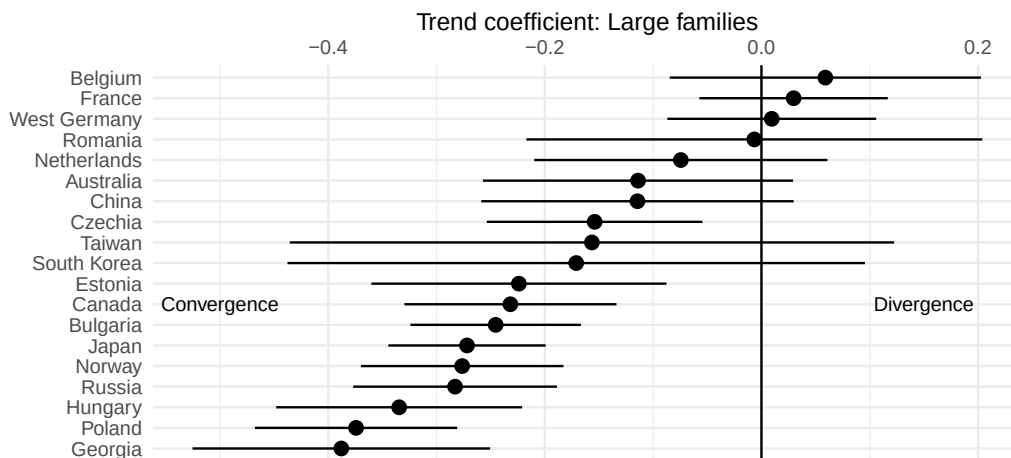


Figure 8: Convergence and divergence of large family prevalence by parental education in 19 countries, 1901–90 birth cohorts. Countries with non-linear trends excluded. Error bars indicate 95 per cent confidence intervals. *Source:* ISEAD (Monden et al. 2018), own calculations.

Thirdly, we see a general trend towards convergence of social disparities over the course of the twentieth century. Figure 8 reveals that eleven countries show a clear trend towards convergence. Three countries (West Germany, Romania, and Belgium) show a trend towards divergence, but do not reach the conventional levels of statistical significance. Seven countries, which are not shown in Figure 8 because of their non-linear trends (East Germany, Italy, Lithuania, Spain, Sweden, United Kingdom, and USA), mostly indicate stability over the course of the 20th century, according to Figure 7. In terms of regional variation, no clear patterns arise.

Disparities in sibship size, distinguishing between paternal and maternal education

Jalovaara et al. (2019) had found important gender differences in educational differentials for cohort fertility and childlessness in Nordic countries. Figures 9 and 10 stratify trends in average sibship size by maternal and paternal education. The pattern here is very similar to the one shown in Figure 3, where parental education was determined according to the dominance principle. Given that men on average had higher educational attainment across much of the 20th century (less so in recent cohorts), the similarity between Figures 3 and 10 is not surprising. For mother's education, we can see that disparities and changes are more moderate for maternal education (Figure 9) than for paternal education in Figure 10 (or 3, for that matter). This can also be expected because disparities in mother's education should be moderate than in father's. There is homogamy (the correlation between father's schooling and mother's education) but such a homogamous tendency is not perfect (that is, the correlation is never close to 1), so we can expect Figures 9 and 10 show similar patterns but Figure 9 shows much more moderate trends.

Figure 11 compares the overall trend over time in average sibship size by paternal and maternal education in a formal manner, showing that 95 % confidence intervals overlap in all countries where both men and women follow linear trends.

Summary and discussion

Our analysis of sibship sizes in nine birth cohorts across the twentieth century and in 26 low-fertility countries showed that sibship size has declined in virtually all of these 26 countries. As sibship size is an important factor affecting children's early and later life outcomes, this finding sends a positive message of declining social inequalities stemming from sibsize effects. As was expected, this was largely due to a uniform and often strong trend towards fewer large families. With respect to only-children, trends are less pronounced,

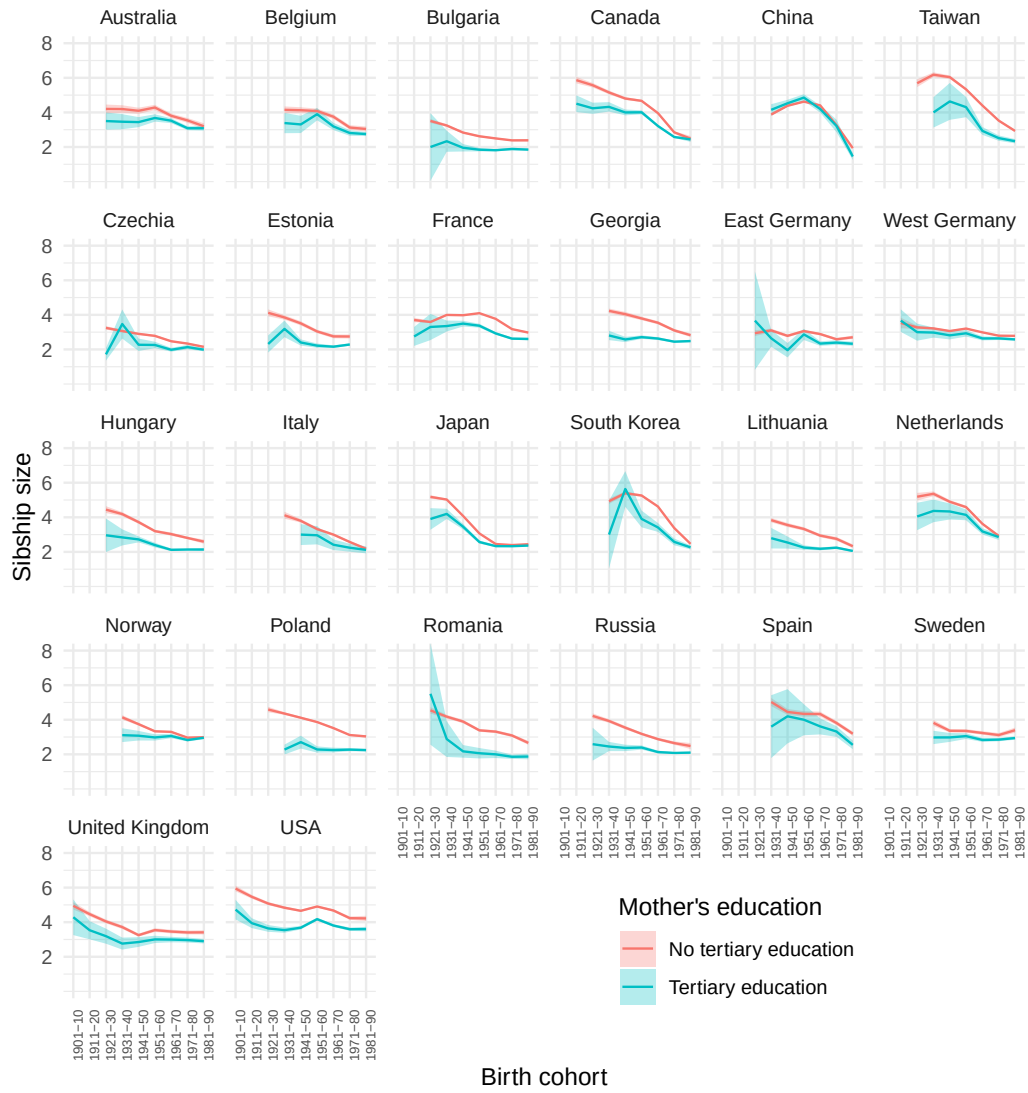


Figure 9: Sibship size by *maternal* education in 26 countries, 1901–90 birth cohorts, $N = 519,731$. Error bands denote 95% confidence intervals. *Source*: ISEAD (Monden et al. 2018), own calculations.

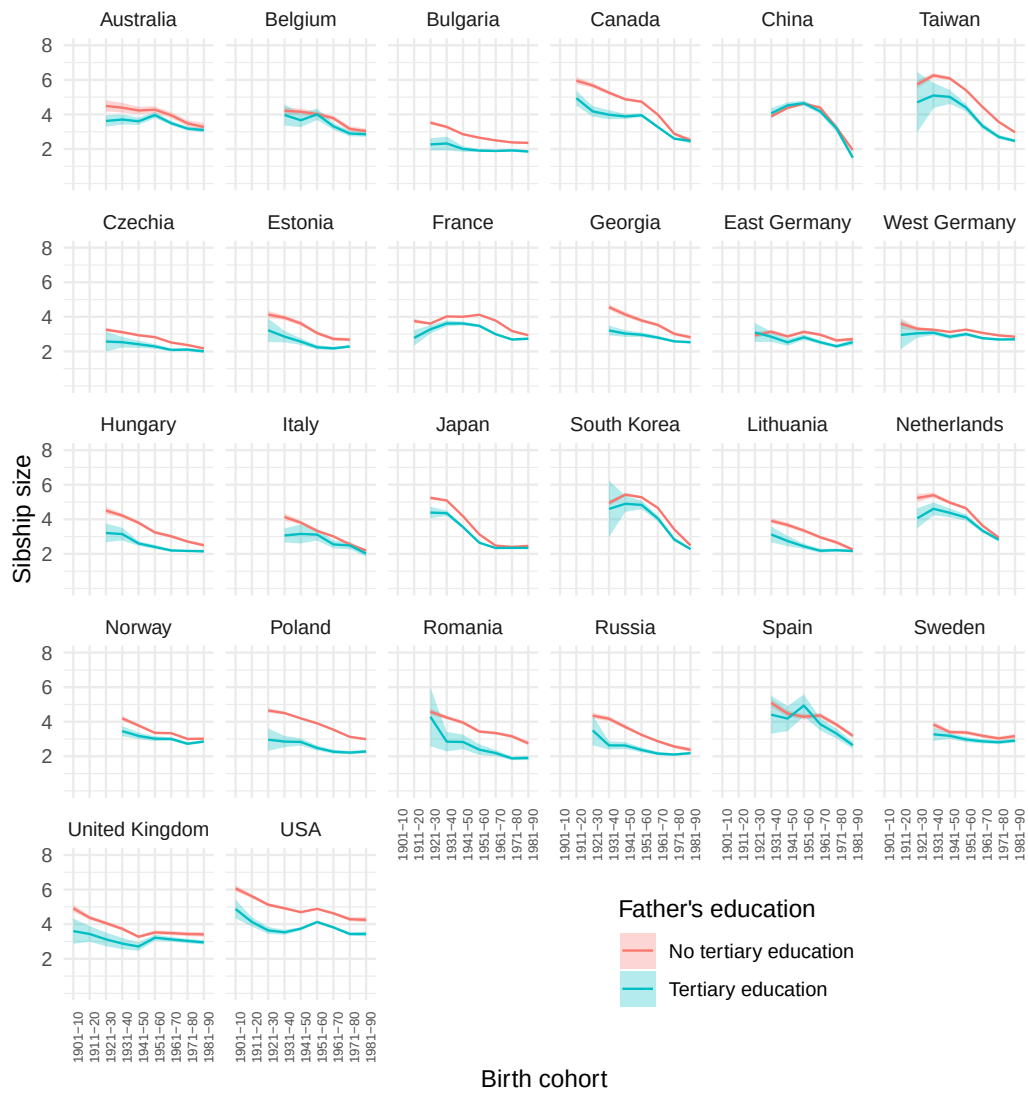


Figure 10: Development of sibship size by *paternal* education in 26 countries, 1901–90 birth cohorts, $N = 495,848$. Error bands indicate 95 per cent confidence intervals. *Source*: ISEAD (Monden et al. 2018), own calculations.

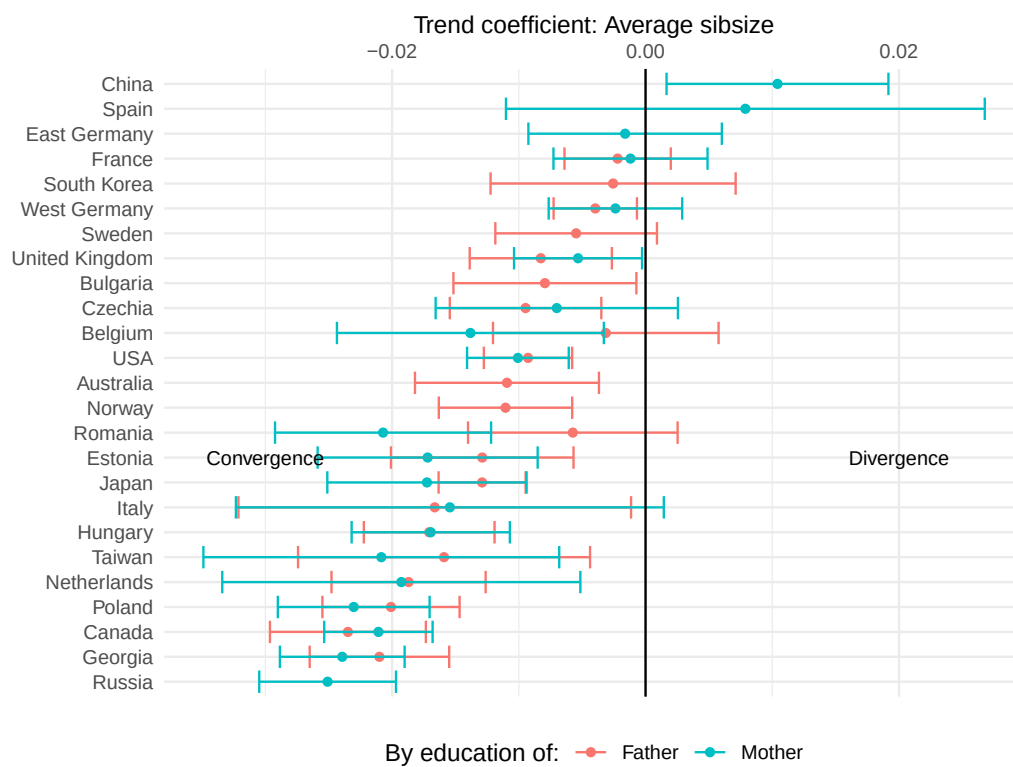


Figure 11: Convergence and divergence of sibship size disparity by paternal and maternal education in 25 countries, 1901–90 birth cohorts. Only linear estimates are shown. Error bars indicate 95 per cent confidence intervals. *Source:* ISEAD (Monden et al. 2018), own calculations.

with disparities being largely stable in most countries.

Social disparities in sibship size are becoming smaller. Sibship size is socially stratified, children of parents with lower education grow up in larger families than children of higher-educated parents. In our study, this holds true across virtually all countries and all points in time. Yet, the differences are becoming smaller. Fahey (2017) argues that the convergence of sibship sizes in the US is an oft-overlooked social trend. We find support for Fahey’s (2017) optimistic notion of a ‘sibsize revolution’ in the low-fertility countries we selected for this study. The vast majority of countries show a converging trend between the number of children of higher and lower educated parents, suggesting that any negative sibling effects are occurring less often these days. Further, in most countries, the decline is greater than in the US, suggesting that Fahey’s (2017) finding based on the US data shows the lower bound of the ‘sibsize revolution.’ This suggests that the evolution of family size for children are a largely overlooked but nonetheless key driver of the improvement of intergenerational path of inequality not only in the US, but also in many other countries, especially those having undergone the transition to low fertility. Choi et al. (2020) suggest that the negative effect of additional siblings on one’s education has increased over time, yet our analyses here suggest that such an effect might be mitigated by demographic processes: Fewer children experience a larger number of siblings, and the number of siblings is less socially stratified than before.

The convergence in sibship sizes is taking place at the top of the sibship size distribution and not at the bottom. We observe a general decline in the prevalence of large families over the course of the century (with sibship sizes of five and above considered to be large families). While family sizes of children of lower-educated parents are more likely to grow up in larger families than those of higher-educated parents, this gap is closing over time in many countries under study. We find little convergence at the bottom of the sibship size distribution. Prevalences of only-children are largely stable over time, and social disparities in raising only-children only arise in Eastern European countries.

Decreasing sibship sizes can have important implications for public policies and public spending. For example, measures such as child benefits, larger public expenditures on education, and on families reduce the gap in educational achievement between children from small and large families (Park 2008). However, our results make clear that one should be very careful and avoid designing policy measures on the basis of total fertility rates when what really matters is the size of the family a child grows up in. The recent trend towards increasing childlessness (Sobotka 2017) poses a challenge for policies that assume, based on the total fertility rate, that family sizes are decreasing. The implications for our thinking about child benefits, for instance, would be quite different. Lam and Marteleto (2008) have argued that cohort size and sibship size—which are important because children compete for resources both in the family and at the population level—can even move in opposite directions.

Research on intergenerational social mobility has long been on the forefront of cross-nationally comparative research, assembling large data sets from many societies to examine parent–offspring correlations in socio-economic status across many societies (Featherman, Jones, and Hauser 1975; Lipset and Bendix 1959). Current efforts to advance intergenerational social mobility research by linking it stronger with demographic processes are focusing on single country cases (Breen and Ermisch 2017; Breen and Salazar 2011; Mare 2011; Mare and Maralani 2006; Song and Campbell 2017). Our study is taking this line of research back to a cross-national perspective. Given the potential importance of demographic transitions on the reproduction of social inequalities, this country-comparative approach is an important piece of the puzzle. While our findings show that there is great universality in the trend towards smaller sibship sizes and declining social disparities in sibship sizes, we also find important country variance in these trends.

We have to acknowledge a number of limitations for our analyses. First, the survey data we used usually did not allow us to assess the family structure of siblings. It would be interesting to take into account for instance the time that siblings have lived together and to distinguish between full siblings,

half-siblings, and adopted siblings, but this is not possible across such a large number of data sets, cohorts, and countries. This problem applies particularly for the most recent cohorts, where families have grown more diverse and complex (Brown, Manning, and Stykes 2015). Blake (1981) reported that sibship size is correlated with family structure, such that non-intact families are more likely to have small family size. If this holds in many countries other than the US, which Blake examined, the growing instability of family structure may offset the potential benefits of being brought up in small families, and, therefore, the extent of the ‘sibsize revolution’ might be exaggerated.

Second, due to inclusion of relatively old respondents, our sample might be affected by differential mortality. However, only 3.5 per cent of the respondents are older than 75 years of age, and 12 per cent older than 65. Moreover, from the 1931–40 birth cohort onwards, there are very few respondents over age 65 (7 per cent), going down to 1.5 per cent in the 1941+ birth cohorts. Given differences in mortality and survivorship across socioeconomic statuses, our estimates of disparities should be considered lower-bounds estimates especially for older birth cohorts. This means changing trends could be underestimated. But this possibility corroborates, rather than undermines, our main result of declining disparities. Third, throughout our analyses, we used the same indicator of parental education across the birth cohorts, distinguishing between those with at least one tertiary degree and those without one. Given the educational expansion that occurred during the twentieth century, the groups of individuals obtaining a degree change in their composition over time. An alternative approach would be to use a relative measure of education for comparisons over time—however, this turned out to be not feasible, as education does not follow a well-behaved Normal distribution, particularly over a long period of time and multiple countries, and thus sometimes leaving created cells empty.

The first two limitations are due to the nature of the data we used. Detailed data that link individuals across generation and by relationships are only available for a very small number of countries and even then, we would not be able to look across many birth cohorts. Given the importance of family

for children, it is surprising that simple statistics on family circumstances of children are not available from national statistical offices or similar agencies in any systematic way. It is high time we start producing indicators that directly measure the family circumstance that children grow up in. Analysis of large-scale survey data are helpful in studying trends, but we need more recent and more reliable data, ideally linkable to administrative data, to make further progress.

As we have argued before, sibship size is a linchpin in the intergenerational transmission of resources. Given the decline in average sibship sizes over time and the convergence of social disparities in sibship size, our findings support an optimistic view of reduced social disparities and increasing intergenerational mobility.

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