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IZA DP No. 10664

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Toward Lower Economic Mobility in the
Knowledge Economy?**

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ABSTRACT

Egalitarianism under Pressure: Toward Lower Economic Mobility in the Knowledge Economy?*

Based on complete population data, with the exact same definitions of family class background and economic outcomes for a large number of birth cohorts, we examine post-war trends in intergenerational economic mobility in Norway. Despite only mild fluctuations in standard rank-based summary statistics, we show that men and women born into the lowest parts of the parental earnings rank distribution have fallen considerably behind in terms of several quality-of-life outcomes, such as earnings rank, earnings share, employment propensity, educational attainment, and the establishment of a family. In particular, the prime-age employment rates of lower class sons have declined spectacularly, both because their rank outcomes have deteriorated and because the lowest ranks to an increasing extent have become associated with non-employment rather than low-wage employment. We provide suggestive evidence that higher educational requirements in the labor market has increased the importance of parental encouragement and support and thus enlarged the handicap of being born into a less resourceful family. There is no evidence whatsoever of a relative decline in the lower classes' cognitive abilities.

JEL Classification: J62, D63, J24

Keywords: intergenerational mobility, inequality, cognitive ability

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* This research has received support from the Norwegian Research council (grant # 236992), and is also part of the research activities of the Centre of Equality, Social Organization, and Performance (ESOP) at the University of Oslo. Administrative registers made available by Statistics Norway have been essential. Data on ability scores have been obtained by consent from the Norwegian Armed Forces, who are not responsible for any of the findings reported in the paper.

1 Introduction

Equality of opportunities is a widely accepted aim of economic and social policies. It points toward a society with high intergenerational mobility, i.e., a society that is egalitarian in the sense that its members' chances of success do not depend too much on family background.¹ There is a large empirical literature on this topic focusing on (individual or household) earnings, generally showing that intergenerational mobility varies considerably both between and within industrialized nations. The highest mobility is typically found in the Nordic welfare states and the lowest mobility is observed in the U.S., with the central European countries somewhere between (Corak, 2006; Jäntti et al., 2006; Black and Devereux, 2011, Blanden, 2013; Bratberg et al., 2017). However, the variation within countries is also large, and some regions in the U.S. appear to have mobility levels similar to the Nordic countries (Chetty et al., 2014a).

The present paper contains an in-depth study of social and economic mobility trends in a typical welfare state economy, namely Norway. It adds to a small and inconclusive literature on recent trends in intergenerational earnings mobility, which has had to deal with problems of small sample sizes and/or time inconsistencies in data definitions and in attrition/selectivity. We take the existing literature a step further by providing fully comparable and virtually attrition-free population data for several offspring-parent cohorts, as well as by examining the mechanisms behind intergenerational class mobility in terms of the transmission of earnings-related abilities as opposed to economic opportunities. Our analysis incorporates an exceptionally wide range of welfare outcomes in the offspring generation, such as earnings rank, earnings share, employment, educational attainment, disability program participation, family formation, and mortality. Moreover, we take advantage of complete administrative registers covering almost a 50-year period to explore and assess alternative rank-based social background indicators, measured at alternative stages of the lifecycle and grounded on alternative earnings concepts. We use our preferred rank indicator to study trends in mobility over time for cohorts born between the early 1950s and the early 1980s, with a focus on mobility out of the bottom and top classes.

¹ The concepts of egalitarianism and equality of opportunities have been subject to much discussion in the literature. While the welfarist notion of egalitarianism typically means equality of outcomes (utility), we focus on equality of opportunities here. When we say that equality of opportunities implies that the chances of success do not depend “too much” on family background, we have in mind that it might be neither possible nor desirable to remove the influence of family background completely. Following in the footsteps of Rawls (1958; 1971), Dworkin (1981a; 1981b) and Sen (1985; 1992), there has been a lively debate among economists regarding the normative foundation for redistributive policies, and, in particular, the degree to which differences in biologically and socially inherited abilities and preferences should be compensated; see Roemer and Trannoy (2015) or Ramos and Van de gaer (2016) for recent surveys.

As we explain in more detail below, the literature on trends in intergenerational earnings mobility has been held back by methodological difficulties associated with imperfect and asymmetric data, which has raised serious questions about comparability across birth cohorts. These difficulties involve the selection of earnings/income concept and age of measurement, the comparison of earnings obtained at different stages of the lifecycle, the treatment of attrition and (possibly time-varying) sample selectivity, and the handling of observations with zero earnings. In the present paper, we exploit our long series of register based earnings data to construct a class ranking based on a parental earnings concept that includes both parents' earnings during the period in their lives that are most highly correlated with their lifetime earnings. We then compute offspring ranks based on individual earnings during the period in their lives that yields the highest correlation with the parents' rank. Given that we also wish to have fully comparable data for as many birth cohorts as possible, we end up with a parental class ranking based on the sum of parents' earnings during their age 52-58, and an offspring ranking based on individual earnings during age 28-40. In contrast to much of the existing literature, we do not rely on "permanent income" predictions based on earnings records collected at different ages for different birth cohorts, but use exactly the same age intervals for all cohorts included in our analysis. Moreover, we have designed the data such that we can include virtually complete offspring birth cohorts, implying that we avoid the ubiquitous problem of potentially distorting sample selection caused by missing data. Conditional on survival to age 40 and continued residency in Norway at that point, our data include consistently defined earnings ranks for both generations for more than 99 % of every cohort born between 1952 and 1975.

Our findings indicate that typical earnings-based summary measures of economic mobility – such as the intergenerational rank correlation and the intergenerational rank mobility (the average number of classes moved) – have been relatively stable for sons born between 1952 and 1975, with a slight decline in mobility between the 1952 and the 1965 birth cohorts, followed by a corresponding increase afterwards. For daughters, however, there has been a consistent and significant decline in economic mobility throughout the period. As a result, the mobility patterns for sons and daughters have converged, and toward the end of the period we find that class mobility is even lower for women than for men. When we look at economic outcomes by class background in more detail, we find that the relative stability of the mobility summary measures conceal some quite powerful developments at the tails of the class distribution, the most conspicuous being that persons born into the lower classes have fallen considerably behind. For both sons and daughters, we find that those born into the lower economic classes do gradually worse, in terms of own economic rank as well as in terms of relative earnings (measured at age 28-40). For sons, this development is accompanied by a sharp decline in employment. For example, while the employment rate (also measured at age 28-40) for men born into the

highest economic class vigintile (the upper five percentiles) declined by approximately 2 percentage points from the 1952 to the 1975 birth cohort, it dropped by 12 percentage points for men born into the lowest vigintile. For both men and women, we identify a sharp increase in the class gradient of disability program participation (at age 40), and also a small increase in the class gradient of mortality (between age 18 and 40). While disability rates remained stable for men and women born into the top class vigintiles, they increased by as much as 8 and 12 percentage points, respectively, for men and women born into the bottom vigintiles. Mortality rates dropped for all classes, but the drop was smaller at the bottom of the class distribution.

For all generations studied in this paper, there has been a marked class gradient in the chances of finding a life partner (becoming married and/or a parent by age 40) for men, but no such gradient for women. This is in line with theories of hypergamy, suggesting that women give higher priority to a prospective partner's economic potential than men do when they chose a life companion. Based on this theory, we would expect the class gradient in men's marital chances to become steeper in line with the class gradient in economic outcomes. And this is exactly what we see. In particular, we show that men born into the bottom of the economic class distribution have reduced their marital chances considerably relative to men with more advantageous family background. Hence, lower class men have apparently lost out along all the quality-of-life dimensions of employment, earnings, health, companionship, and life expectancy.

Moving on to the role of cognitive ability, we use test scores administered by the armed forces to all Norwegian boys aged 18-19 to show that the class background gradient in the ability distribution is virtually unchanged over the period covered by our data, the only exception being that the very top class has become less dominated by high-ability sons. Hence, we do *not* find support for a meritocracy hypothesis saying that economic success has become more strongly associated with cognitive ability within the parent generation and thus generated a higher correlation between family background and ability in the offspring generation through the genetic transmission mechanism. It could still be hypothesized, though, that the declining mobility out of the lower classes was really about ability rather than about class, as any economic trend resulting in poorer prospects for offspring with low ability more generally would have hit the lower classes particularly hard, since their share of the low-ability offspring is larger. However, we do not find support for this hypothesis either. To the contrary, we show that the difference in earnings rank outcomes between sons with high and low ability has been significantly *reduced* over time. Hence, if anything, the larger share of low ability offspring in the lower classes has been a force for increased earnings rank mobility.

Our interpretation of the improvement in relative economic outcomes for low-ability offspring is that it has arisen from the huge expansion of educational capacity, which has made secondary and tertiary education accessible to a much larger share of the population, including many of those with low cognitive ability. This has leveled the playing field across ability groups. However, we also argue that this same development is likely to have been behind the deteriorating economic mobility out of the bottom classes. As educational attainment has gradually become a more essential ingredient of economic success, support and encouragement from the family has gained importance. In combination with the existence of a steep social gradient in the provision of such support, this has reinforced intergenerational persistence in economic outcomes, at least at the bottom of the class distribution.

In line with recent findings from the U.S. (Chetty and Hendren, 2015; Chetty et al., 2016), we find that the economic status of the childhood neighborhood is highly correlated with adult outcomes, particularly for lower class offspring. For sons, we see some indications that the difference in expected earnings ranks between growing up in rich and poor neighborhoods has declined over time, whereas for daughters the differentials have been stable or slightly increasing. Since the neighborhood differentials were considerably larger for sons than for daughters to start with, this has implied a convergence between sons and daughters in the way own economic outcomes correlate with the status of the childhood neighborhood. We see some indications of increased neighborhood-differentials in disability program participation, and argue that this development can be explained by peer effects. Neighborhoods have also become *less* segregated over the parent-generations studied in this paper, in the sense that the correlation between the rank of the parents and the average rank of their neighbors has declined. This development has probably been a force for increased economic mobility.

The findings reported in this paper add to a small, but fast-growing empirical literature on post-war trends intergenerational economic mobility. Most of the contributions to this literature have examined the development of intergenerational earnings elasticities and/or brother correlations, and have thus, in contrast to our own contribution, primarily focused on economic mobility *conditional* on employment (or positive earnings/income). Important contributions to this literature include Hertz (2007) and Lee and Solon (2009) for the U.S., Blanden et al. (2004) and Nicoletti and Ermisch (2007) for the U.K., Lefranc and Trannoy (2005) for France, Björklund et al. (2009) for Sweden, Pekkala and Lucas (2007) for Finland, and Bratberg et al. (2005) and Hansen (2010) for Norway. Taken together, these studies do not provide a fully coherent picture of trends in intergenerational mobility, as they rely on different types of data and/or different measurement strategies. For example, while Bratberg et al. (2005) use the fathers' earnings only to identify economic background, and report increased economic mobility for sons born in the period from 1950 to 1965, Hansen (2010) uses the *sum* of the mothers' and the

fathers' earnings and show that this leads to the conclusion of stable intergenerational earnings elasticity for the same period.²

More recent contributions also incorporate trends in intergenerational rank-rank associations, and are thus more similar to the approach used to study earnings mobility in the present paper. For the US, this includes Chetty et al. (2014b), who present intergenerational family income rank-rank slopes for offspring born between 1971 and 1993, based on administrative tax returns data. Offspring incomes are recorded somewhat differently for different birth cohorts, however, due to incomplete data.³ The main conclusion coming out of this exercise is that intergenerational rank-rank mobility has been stable throughout the period, with rank-rank correlations hovering around 0.30.

The study that comes closest to our own is Pekkarinen et al. (2017), who report trends in intergenerational rank-rank earnings mobility for sons born in Norway between 1932 and 1974. As in Bratberg et al. (2005), only the fathers' earnings are used to identify the sons' economic background in the intergenerational analysis. It is supplemented by an examination of trends in the earnings correlations between brothers. In the main part of the analysis, offspring earnings are recorded at age 35 for all cohorts, whereas the earnings of fathers are recorded between age 55 and 64. The key findings are that the rank-rank correlation coefficient has remained remarkably stable at 0.19-0.20 for all post-war birth cohorts. At the same time, however, brother correlation has declined, indicating higher economic mobility in this period.

The rest of this paper is structured as follows. The next section provides a brief discussion of the sources of intergenerational class persistence. Section 3 describes our data, and discusses alternative strategies for identification and measurement of class background as well as offspring outcomes. Section 4 provides our estimates on trends in intergenerational mobility, as captured by earnings and employment, education, disability program participation, family formation, and mortality. Section 5

² The Nordic studies are all based on administrative registers, whereas the U.S., U.K., and French studies referred to here are all based on survey data: The Panel Study of Income Dynamics (PSID) for the U.S., the National Child Development Study (NCDS) and the British Cohort Survey (BCS) for the U.K., and the Education-Training-Employment (FQP) survey for France. All the studies mentioned here also differ in the choice of age for earnings measurement and/or in the way this is controlled for in the analysis. While there appears to be a general agreement that intergenerational mobility has declined for women, the results for men differ; from increased mobility (Bratberg et al., 2005 for Norway), via stable mobility (Hertz, 2007, and Lee and Solon, 2009, for the US., Lefranc and Trannoy, 2005, for France, and Hansen, 2010, for Norway), to declining mobility (Blanden et al., 2004 and Nicoletti and Ermisch, 2007, for the UK; Björklund et al., 2009, for Sweden, and Pekkala and Lucas, 2007, for Finland)

³ Incomes are recorded at age 29-30 for the 1971-82 cohorts, and forecasted for the same age-interval on the basis of recorded income at age 26 or college attendance for the 1983-86 and 1987-93 cohorts, respectively. Parents' incomes are measured when the offspring were aged 15-19.

provides evidence on the mechanisms behind the observed mobility trends, with a particular emphasis on the role of cognitive ability and childhood neighborhoods. Finally, Section 6 concludes.

2 Sources of intergenerational class persistence

The theoretical literature on economic mobility highlights that intergenerational persistence in economic outcomes operates through the heritability of earnings-related traits as well as through investments in human capital; see, e.g., Becker and Tomes (1979; 1986) and Solon (1999; 2004). The degree of economic class persistence is then higher the higher is the genetic and environmental transfer of earnings-related ability, the higher is the efficacy of parental human capital investments, and the higher is the return to human capital. To the extent that human capital investments are provided by the public sector, the degree of persistence is lower the higher is the progressivity in these investments; i.e., the more they are directed toward low-class families.

A distinguishing feature of a welfare state economy like Norway is that human capital investments are largely paid for by the government. Education in Norway is free of charge, from primary school (starting at age 6) through college/university; and tertiary education also entails access to study grants and subsidized loans covering living expenses. The allocation of limited educational capacity (in terms of admission to particular fields of study and/or particular schools/colleges/universities) is primarily determined on the basis of grade points obtained at lower education levels. Hence, parental *economic* resources do not play a big direct role (if any) in the distribution of educational investments. A possible exception is pre-school (kindergarten), for which there is a fee to be paid by the parents, currently covering around 12 % of total costs, but with a ceiling amounting to 6 % of household income. The quality of educational institutions is also considered relatively homogenous, at least in the sense that it is not systematically better for the higher classes. The distribution of public resources across different schools is in many municipalities designed to compensate for differences in costs related to pupil composition, such that schools in relatively poor areas get more resources per pupil than schools in affluent areas. Private schools play a modest role.

Given these attempts to level the playing field across economic classes, we expect that the intergenerational transmission of economic outcomes is dominated by the genetic transfer of ability, by the social transfer of skills and preferences, by the degree of support and encouragement received from family, neighbors and peers, and by access to career-promoting networks.⁴ This does not necessarily

⁴ Based on quasi-random assignment of Korean-Norwegian adoptees, Fagereng et al. (2015) show that family background has a considerable *non-genetic* impact on economic behavior as reflected in risk-taking and wealth accumulation.

imply that the class mobility is higher than it would have been without welfare state involvement. As argued by Landersø and Heckman (2017), the redistributive tax and welfare policies typically pursued in Scandinavian welfare states provide weak incentives to invest in non-inherited skills, potentially raising the relative importance of family background and thus impede economic mobility.

While we normally think of high economic class mobility as a desirable property of an economic system, as it reflects *equality of opportunities*, it will not *necessarily* be the case that higher mobility is always a good thing. In particular, to the extent that class *immobility* emanates from the genetic and social transfer of ability, we would expect that societal changes in the direction of meritocracy – as opposed to nepotism and cronyism – will lead to lower class mobility over a period of time, *ceteris paribus*; see Nybom and Sthuler (2014). This would then not be an indicator of less economic fluidity *per se*, but rather reflect that ability and class have become more correlated in the *parent generation*, which then – through genetic/social heritability – has induced a higher correlation between ability and class background also in the offspring generation. In order to interpret observed changes in the intergenerational class mobility patterns, it is therefore important to understand the distinct roles of the intergenerational transfer of *ability*, on the one hand, and the transfer of *opportunities given ability*, on the other.

In the present paper, we examine cohorts born between the early 1950s and the early 1970s or 1980s (depending on outcome), and these cohorts have been exposed to quite different welfare state institutions, learning environments, and labor markets. For example, while kindergartens were almost non-existing for the children born in the early 1950s they included roughly 40 % of 3-5 year old children born around 1980.⁵ While 35 % of the individuals born in the early 1950s completed an upper secondary education, this was the case for 81 % of those born in 1980. The corresponding fractions with bachelor's and master's degrees increased from 22 % to 43 % and from 4 % to 10 %, respectively. During the same time period, labor markets changed markedly, with rising female labor force participation, rising skill requirements, increased competition from international trade, and increased earnings inequality. Social insurance and transfer programs expanded, with rising coverage rates for the non-employed.

Throughout the period covered by this paper, secondary and tertiary education has been provided free of charge and with a qualification-based admittance policy, thus – at least in principle – invalidating any class differences in access caused by financial/liquidity barriers or discrimination/favoritism. Yet,

⁵ More recently, the coverage rate for 3-5 year old children has reached almost 100 %, whereas the coverage rate for 1-2 year old children has reached 80 %.

it may still be the case that the gains from the expansion of educational opportunities have been unequally allocated across economic classes. This could, for example, be the case if the increased capacity has been disproportionately allocated to higher-class offspring due to their higher average cognitive ability, or if education has served as a complement to cognitive ability in the formation of marketable human capital. It could also be the case if family support and encouragement are important inputs in the production of educational outcomes, as empirical evidence has indicated that lower class families provide less such encouragement and support; see Mayer et al. (2015). In particular, it has been shown that economically advantaged parents produce more cognitively stimulating home learning environments, and spend more time on supporting their children's education (Guryan et al., 2008; Kalil, et al., 2012). Generous provision of free education is then not at all a panacea for a more equal and class-independent distribution of labor market skills; and expansions of free education may in principle cause economic mobility to decline rather than to increase.

To the extent that the intergenerational transmission of economic status arises from the transmission of innate or acquired earnings-related skills, we also expect the degree of class mobility to mirror changes in the value of skills more generally. There is now a large literature discussing the extent to which recent changes in technology and trade patterns have been skill-biased, and thus contributed to changes in earnings inequality and/or employment patterns across skill groups; see, e.g., Acemoglu and Autor (2011) for a recent review. A typical view is that the demand for high skills outpaced the supply during the 1980's (Katz and Murphy, 1992; Autor et al., 2008), that there was polarizing decline in the demand for medium skilled labor continuing into the 1990's (Autor et al, 2003; Goos et al. 2014), and that the increasing demand for high skills may have gone into reverse after the turn of the century (Beaudry et al., 2015). Since skills are correlated with economic class – both through nature and nurture – any such skill-biased developments have potentially also been a source of changing class mobility.

3 Data and identification of economic class

The analysis in this paper is based on encrypted complete administrative register data for Norway with inter- and intra-generational family linkages. The earnings data comprise all reported pension-point generating labor earnings, including both wages and self-employment income. They are available for all residents on an annual basis from 1967 to 2015; hence they provide information about considerable parts of the earnings histories for a large number of birth cohorts. For a few birth cohorts they provide complete lifecycle earnings histories.

In addition to earnings data, we exploit in this paper a number of other register data sources to capture alternative quality-of-life outcomes. These include data on educational attainment, cognitive ability (men only, based on tests done at enrolment to military service), social insurance claims (from 1992), mortality, marital status, parenthood, and residential neighborhood.

Based on earnings data for the parent generation, we identify social/economic background for all persons born in Norway between the early 1950s and the mid-1980s. However, as we explain in more detail below, given that the various earnings and quality-of-life indicators are measured at different stages of the offspring's life cycle, the birth cohorts actually used in the intergenerational analyses will vary somewhat across the different outcomes.

While much of the economics literature on social mobility focuses on intergenerational associations of earnings (or income) levels, the analysis in the present paper builds entirely on a rank-based understanding of economic background. This approach encapsulates the idea that is not only the *level* of parental earnings that is relevant for the offspring's future outcomes, but also their *rank*, relative to other parents. As we show below, a rank-based measure of economic background has the, for our purpose important, advantages that it can be constructed for everyone (regardless of labor force participation) and that it *by construction* exhibit exactly the same marginal distribution for all birth cohorts. In the analysis of intergenerational earnings mobility, we will use rank measures in both generations, in line with recent contributions by Dahl and DeLeire (2008), Chetty et al. (2014a; 2014b), Corak et al. (2014), Bratberg et al. (2017), and Pekkarinen et al. (2017).

An earnings-based ranking criterion has similarities with the class rankings based on education or occupation frequently encountered in the sociology literature; see Blanden (2013) for a recent survey. We will argue, however, that large changes in the distributions as well as social statuses of educations and occupations make it extremely difficult (if not impossible) to establish ranking algorithms based on education and occupation that have a reasonably stable interpretation over time.

An earnings-based ranking measure encapsulates a number of plausible transmission mechanisms, such as parental investments, genetic and environmental transfer of ability and work ethic, the impacts of social status, access to influential networks, and peer influences. To pick up the direct role of the household's economic resources, it would probably be preferable to base the ranking on households' permanent income (Friedman, 1957), as measured by total net income over the lifetime, regardless of income source. However, non-labor income, such as social insurance transfers, may correlate negatively with genetic and environmental sources of immobility, and hence contribute to attenuate intergenerational correlations in social status and labor market success. We have thus chosen to focus on

total gross labor-earnings (including self-employment income) as a foundation for ranking in this paper.⁶ Lifetime earnings may still be the best indicator of parental resources and social status, though. Hence, although we cannot observe lifetime earnings for many generations, we will seek to use available earnings data such that we obtain rankings that as closely as possibly resemble rankings based on lifetime labor earnings.

As we explain in more detail below, we implement in this paper an economic family background ranking based on 20 bins – or *vigintiles* (sometimes also referred to as ventiles). That is, the members of each annual birth cohort of sons/daughters are divided into 20 *economic classes* based on their parents' earnings, where class 1 contains the five percent of offspring with parents in the lowest earnings bin, and class 20 contains the five percent with parents in the highest earnings bin (more details on how we do this below). There are two reasons why we settle for 20 classes rather than the 100 percentiles used by, e.g., Chetty et al. (2014a). The first is that we then circumvent the problem that more than one percent of the families tend to have zero earnings, which makes it difficult to provide a meaningful fine-grained classification at the bottom of the earnings distribution.⁷ The second is that it reduces disturbing noise in settings where we have few observations.

We now turn to a discussion about which and how many years to include in order to appropriately reflect individual parents' permanent earnings and how to combine the two parents' earnings into a class ranking. The issue of *which* years to include is related to how earnings obtained at different stages of the lifecycle correlate with lifetime earnings. This topic has been subjected to extensive discussions in the literature, and the error associated with choosing a measure that is not perfectly correlated to lifetime earnings is referred to as *lifecycle bias* (Solon, 1999; Grawe, 2006). According to Haider and Solon (2006), this bias can be large, but is minimized when incomes are measured around age 40. Recent studies from both the U.S. (Chetty et al., 2014a) and Norway (Nilsen et al. 2012) indicate, however, that the problem is modest for studies of intergenerational mobility when earnings are measured in the thirties. This view is challenged by Mazumder (2015), who shows that measurement of offspring earnings in the early thirties give rise to substantial lifecycle bias in the U.S. The issue of *how many* years that needs to be included in order to satisfactorily capture permanent earnings has also been subjected to extensive discussions in the literature. If the earnings measure includes very few years, the identification of economic class may be disturbed by temporary (not representative) earnings fluctuations. In the literature, this is referred to as *attenuation bias* (Solon, 1992). While sources of lifecycle and attenuation bias have been shown to potentially be of great importance for the calculation of

⁶ Data on gross labor earnings are also available for a much longer period of time. We return to the distributional role of taxes and transfers in the final section of the paper.

⁷ With the earnings concepts used in this paper, the number of zeros never exceeds five percent.

intergenerational earnings elasticities and correlations, they appear to be less critical for the calculation of rank-rank based mobility measures; see Chetty et al., (2014a) and Nybom and Stuhler (2017).

To shed some additional light on how best to combine limited panels of multigenerational earnings data to examine economic mobility, we take a closer look at a few birth cohorts for which we have access to complete lifecycle data on annual earnings; i.e., persons born in 1945 or 1946. Figure 1, panels (a) and (b) present the correlations between lifetime earnings (the sum of earnings obtained between age 22 and age 67, adjusted for general wage growth) and alternative earnings averages taken over shorter time periods at different stages of the lifecycle, whereas panels (c) and (d) present corresponding correlations between vigintile ranks based on lifetime and shorter period earnings.⁸ There are four important points to note from these graphs. First, it appears that the correlation between annual and lifetime earnings is highest for earnings obtained in the mid or late fifties, which is somewhat later in the lifecycle than what has been recognized in the literature so far. Second, while the correlation increases substantially as we move from single years to 3-7 year averages, the extra increases obtained by adding even more years to the averages are moderate. Third, the correlation patterns are roughly the same for earnings levels and earnings ranks. And fourth, the correlation patterns are similar for men and for women, with the exceptions that earnings obtained in the twenties are much less correlated with lifetime earnings for men than for women, whereas earnings obtained in the thirties are a bit less correlated to lifetime earnings for women than for men.

⁸ Throughout this paper, we use the adjustment factor in the Norwegian pension and social insurance system to inflate/deflate earnings from different years to a common earnings-metric. This corresponds approximately to an adjustment for aggregate wage growth.

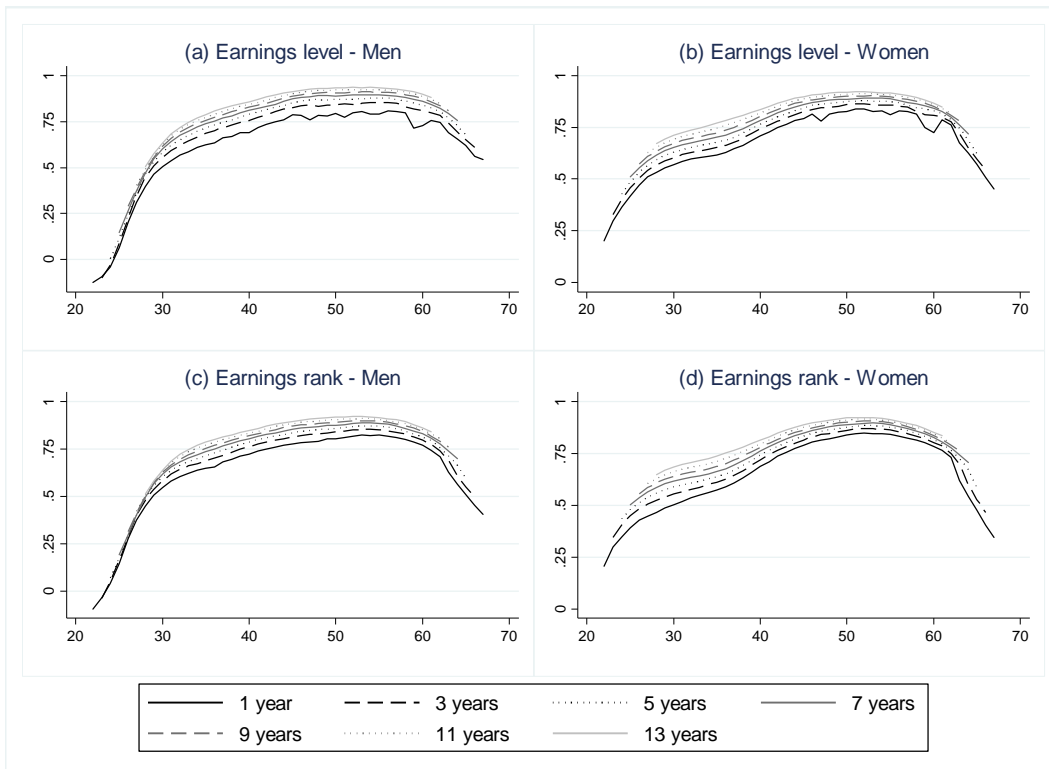


Figure 1: Correlation coefficients between lifetime labor earnings/earnings ranks (ages 22-67) and alternative age-specific averages. Cohorts born in 1945 and 1946.

Note: The multiple year averages are centered on the age indicated at the horizontal axis.

The finding that class rankings based on earnings measured in the fifties provide the highest correlation with rankings based on lifetime earnings is in some sense good news for researchers attempting to identify economic background on the basis Norwegian earnings data. Given that we have complete earnings data from 1967 to 2015, it implies that earnings obtained during the fifties are available for all persons born between 1915 and 1955, which includes virtually all parents to kids born between the early 1950s and late 1970s. In this paper, we are going to measure economic class background on the basis of each parent's earnings obtained during the seven-year period from age 52 through 58.

We now turn to the issue of how to combine the two parents' earnings data into an economic class ranking attributable to their offspring. Most studies of mobility within both sociology and economics use a classification based on the father's labor earnings only (Hansen, 2010). More recently, influential studies have relied on household income (e.g., Chetty et al., 2014a), whereas Markussen and Røed (2016) use the maximum of father's and mother's labor earnings. The latter is motivated by the argument that the economic roles of fathers and mothers may have changed considerably, implying that

both pure father-based and sum-based ranking measures potentially have changed social class connotation over time. For example, while a homemaking mother was a signal of high social class in previous generations, it may (sometimes) be a signal of low class now.

Here, we take a rather pragmatic view on this, and seek to find the parental earnings rank measure that displays the highest possible correlation with the economic success of the offspring, while at the same time having a reasonably stable social class interpretation over time. To divide each offspring birth cohort into economic classes based on their parents' earnings position, we also have to take into account that their parents are not all born in the same year, and that their age-specific earnings-averages thus are measured in different calendar years. We deal with this problem by, for each offspring birth cohort, regressing the relevant parental earnings concept on year dummy variables, and then use the residuals to construct the vigintile ranking. This way, we ensure an exact same distribution of economic class backgrounds for all offspring birth cohorts.⁹

To identify the "best" earnings concept for the parent generation in terms of its ability to predict offspring outcomes, we also need to decide on a ranking measure for the offspring generation. We thus seek to find the combination of earnings years in the offspring generation that yield the strongest association between the ranks of parents and offspring. A statistic designed to capture the overall degree of intergenerational persistence, which has previously been applied in the literature, is the intergenerational rank correlation (IRC); i.e., the correlation between the parents' and the offspring's ranks (or, equivalently, the regression coefficient); see Dahl and DeLeire (2008), Chetty et al. (2014a), and Bratberg et al. (2017). Figure 2 presents a number of intergenerational rank correlations based on the three alternative parental earnings measures (father's earnings, max of mothers and father's earnings, and sum of fathers and mother's earnings) and a number of alternative measurement periods for individual offspring earnings for offspring born between 1952 and 1957. We have chosen these birth cohorts for this particular exercise for the reason that their earnings data are available for almost a full lifecycle (up to age 60). Although the sons' rank correlations tend to be very similar for the three parental earnings concepts, it turns out that a ranking based on the sum of parental earnings (panel (e)) yields slightly higher correlation than the other earnings concepts (panels (a) and (c)) almost regardless of the age at measurement. For daughters, the sum based ranking (panel (f)) yields considerably higher rank correlations. It also appears to be the case that the intergenerational rank correlation becomes highest for sons when we measure their earnings up to around age 40, whereas it becomes highest for daughters when we measure their earnings up to around age 50. For sons, it is notable that earnings

⁹ An alternative strategy could have been to rank parents on the basis of comparisons within *their own* birth cohorts instead. But in that case, the distribution of economic class backgrounds could vary across offspring cohorts.

obtained very early in the life-cycle are weakly – and for some ages even negatively – correlated with class background. Finally, the correlation for both sons and daughters is higher the more years we include in the offspring earnings measure.

Given our limited data window, it is clear that we can include fewer offspring birth cohorts in our analysis the later in the lifecycle we measure their earnings. Hence, although measurement up to age 50 appears to be preferable for daughters, we have decided to base our offspring ranking on data up to age 40. With the data available to us, this implies that we can study birth cohorts up to and including 1975. Since there are little restrictions on data availability in the other end, we can include a large number of years in the earnings measure used to rank offspring. We have thus decided to use total earnings over the age 28-40 period as a foundation for ranking (we exclude years prior to age 28 to avoid a potentially time-changing influences of education). When we combine this with the requirement that the earnings of the parents can be observed during their ages 52-58, we end up with a consistent identification of both parental class background and offspring earnings for virtually everyone born between 1952 and 1975; see Table 1. Most of our analysis will be conditioned on survival and residence in Norway at age 40, and given this restriction, we are able to identify class background for more than 99 % of every birth cohort; see column II.¹⁰ In total this gives us around 50-60,000 offspring observations per birth cohort and 1.3 million observations in total. In addition, it gives us around 175,000 brother-pairs and 164,000 sister-pairs that we will use to assess robustness of our findings with respect to time trends in economic mobility.

¹⁰ Identification of class background requires that at least one of the parents was alive and resided in Norway at some point between age 52 and 58. For parents who were present only in some of the years (due to death or migration), we have imputed the “missing” years by using the closest available “neighbor-years” instead.

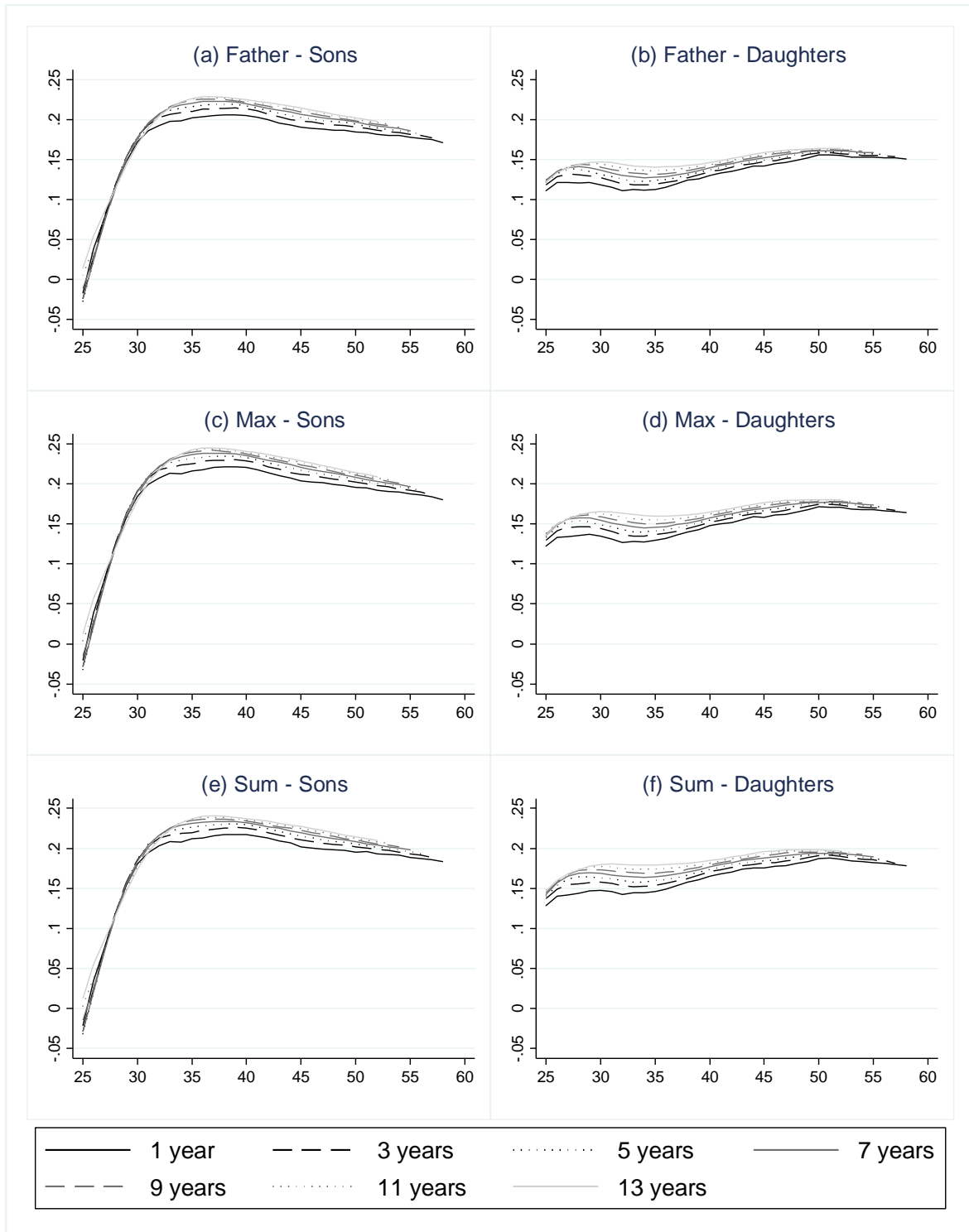


Figure 2. Intergenerational rank correlations (IRC) based on alternative offspring earnings averages. Parental rank based on mothers and father's earnings age 52-58. Offspring born in 1952-1957.

Note: The multiple year averages are centered on the age indicated at the horizontal axis. Panels (a) and (b) show IRC when only the father's age 52-58 earnings are used for ranking purposes, panels (c) and (d) show IRC when the highest of the father's and the mother's age 52-58 earnings are used and panels (e) and (f) show IRC when the sum of the father's and the mother's age 52-58 earnings are used.

Table 1. Overview of the offspring samples used in the main analysis

	I	II	III	IV	V
	Number of potential observations	Fraction with identified economic background	Number of observations used in the analysis	Number of brother pairs (max 5 year age difference)	Number of sister pairs (max 5 year age difference)
1952	50 356	0.994	50 060	7 660	6 679
1953	52 929	0.994	52 598	7 924	7 491
1954	53 130	0.994	52 820	8 076	7 590
1955	54 200	0.994	53 887	8 538	7 967
1956	54 939	0.994	54 612	8 728	8 294
1957	53 951	0.994	53 653	8 876	8 188
1958	54 325	0.995	54 048	9 008	8 557
1959	54 557	0.994	54 230	9 183	8 923
1960	53 484	0.994	53 184	9 318	8 820
1961	53 938	0.995	53 646	9 760	9 146
1962	53 676	0.995	53 385	9 868	9 283
1963	54 735	0.994	54 429	10 015	9 528
1964	56 691	0.994	56 374	10 486	9 457
1965	57 163	0.994	56 846	10 077	9 336
1966	57 923	0.995	57 615	10 017	9 235
1967	57 584	0.994	57 259	9 592	9 040
1968	58 652	0.995	58 381	9 752	9 260
1969	58 991	0.995	58 696	9 350	8 812
1970	56 136	0.995	55 864	8 628	8 161
1971	56 728	0.995	56 461		
1972	55 431	0.996	55 203		
1973	52 599	0.996	52 393		
1974	50 978	0.996	50 757		
1975	47 780	0.996	47 597		
Total	1 310 876	0.995	1 303 998	174 856	163 767

Note: The total numbers of observations are all persons born in Norway by two Norwegian-born parents in the respective years, and who are still alive and residing in Norway by age 40. The numbers of brother and sister pairs refer to pairs with a maximum age difference of five years. The pairs are assigned to the birth year of the first-born sibling. For example, the number of brother pairs in 1952 of 7660 indicates that there were 7660 boys born in 1952 who got a brother within five years.

To examine the stability of three alternative parental income concepts, in terms of their class interpretation, we divide the offspring samples described in Table 1 into four six-year periods, and compare the three alternative offspring-parent rank-rank correlations based on age 52-58 parental earnings and age 28-40 offspring earnings; see Table 2. As it turns out, the relative performance of the three alter-

native rank correlation measures is almost the same for all time periods for both sexes: Offspring earnings are most strongly correlated with the *sum* of parents' earnings and least strongly correlated with father's earnings. The differences between the three measures are particularly large for women.

Based on these findings, we are going to use the *sum* of both parents' earnings during their respective ages 52-58 as a foundation for assignment of the offspring's class background. To assess the sensitivity of the estimated trends in intergenerational earnings rank mobility with respect to this choice, we will compare mobility measures based on parental background with measures based on brother and sister associations. For the offspring generation, we will base our earnings ranking on total individual earnings during age 28-40 (13 years). By using such a long time period, we hope to avoid potentially time-varying sources of lifecycle bias related to cohort-specific patterns in the evolution of income inequality over age; see Nybom and Stuhler (2016). However, as we return to in the next section, our overall assessment of intergenerational mobility will be based on other quality-of-life indicators also.

Table 2. Rank-rank correlations based on offspring earnings age 28-40 and parental earnings age 52-58

	Men				Women			
	I	II	III	IV	V	VI	VII	VIII
	<u>1952-57</u>	<u>1958-63</u>	<u>1964-69</u>	<u>1970-75</u>	<u>1952-57</u>	<u>1958-63</u>	<u>1964-69</u>	<u>1970-75</u>
Father earnings only	0.217	0.221	0.217	0.207	0.140	0.161	0.178	0.185
Max of father and mother	0.230	0.231	0.226	0.214	0.156	0.178	0.198	0.206
Sum of father and mother	0.226	0.233	0.231	0.225	0.180	0.206	0.230	0.244
Number of obs.	162 263	164 363	176 585	162 509	155 640	158 989	169 412	156 790

As we are going to use earnings ranks to establish economic class background as well as the offspring's own economic outcomes, it may be of some interest to see how large the earnings differences actually are between the vigintiles in parent and offspring generations, and also to check whether these differences have changed over time. Figure 3, panel (a), reports the fraction of overall parental earnings allocated to each vigintile for the parents of the first six and the last six of the birth cohorts used in our study. It illustrates that the earnings distribution is quite compressed, and also that it has been remarkably stable over the parent generations examined in this paper. For both periods, only the very top parent vigintile obtained more than 10 percent of total earnings, and only the very bottom vigintile obtained less than 2 percent. When we compare the parents of the 1952-57 birth cohorts with the parents of the 1970-75 birth-cohorts, the only change of interest is that the fraction of earnings earned

by the very top vigintile has increased, at the cost of small share reductions for most other vigintiles. Moving on to the sons' and daughters' individual labor earnings in panels (b) and (c), we see similar earnings share distributions. However, while we see signs of increasing inequality among sons, the inequality among daughters has declined – and also become much more similar to that of sons.

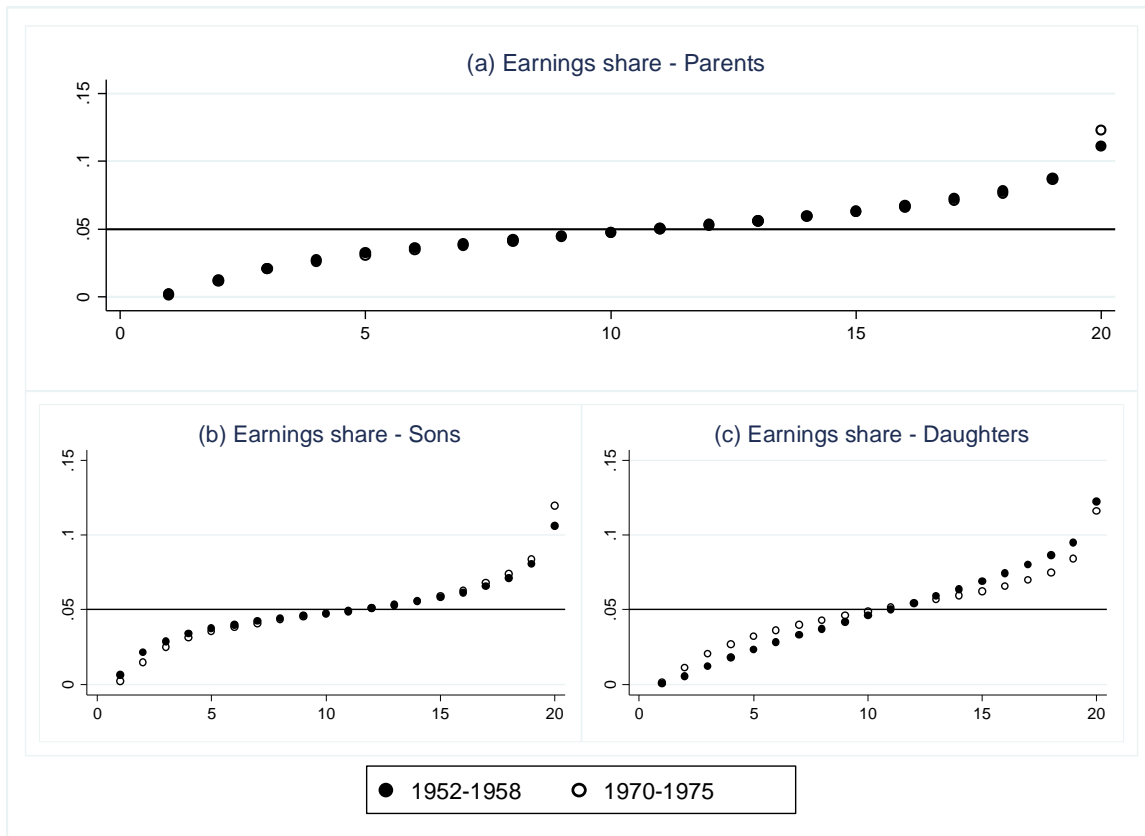


Figure 3. The intra-generational distribution of parental (panel (a)) and offspring (panels (b) and (c)) earnings. By vigintile.

Note: Panel (a) shows the vigintile shares of total earnings for the sum of the two parents' earnings during their respective ages 52-58. Panels (b) and (c) show vigintile shares for offspring earnings during their age 28-40.

4 Trends in intergenerational mobility

In this section, we seek to establish the relationship between economic class (as defined by parents' earnings rank) and a number of offspring outcomes, birth cohort by birth cohort. Our main purpose is to identify any changes in the influence of family background over time. Our outcomes include a range of welfare indicators, such as earnings, employment, education, disability program participation, and marital success. The results are presented graphically, and we switch between two expository approaches. First, in order to assess the nature of the changes in intergenerational class mobility that have occurred between the beginning and the end of our data period, we compare the complete vigintile outcome distributions for selected early and late birth cohorts. Second, in order to assess the time trends in overall class mobility as well as mobility out of the bottom and top classes, we present

some summary statistics for each birth cohort. For these latter statistics, we also show illustrative quadratic trend lines.

For all the statistics presented in this paper, we have assessed the statistical uncertainty by means of a nonparametric bootstrap; i.e., we have randomly resampled (with replacement) 120 distinct datasets consisting of sons and daughters and used those to compute confidence intervals for the statistics of interest. For expository reasons, we will not show standard errors or confidence intervals for all the numbers that we present below. However, we do present confidence intervals for the summary statistics' estimated trend lines. For the large number of cohort- and vigintile-specific data-points, we will convey information about the degree of statistical uncertainty in the text, with more detailed test results reported in the notes below the figures.

4.1 Earnings and employment

To see how the associations between offspring's economic outcomes and their class background have developed over time we start out in Figure 4 with a graphical display of earnings and employment outcomes *by class background* for the first and the last six birth cohorts for which we have access to fully comparable earnings data in both generations; i.e. for the cohorts born in 1952-58 and 1970-75, respectively. The statistics presented in this figure are estimated with high statistical precision. For each vigintile, typical standard errors for the rank-outcomes are around 0.06, for the share-outcomes 0.0002, and for the employment-outcomes 0.004; and 95 % confidence intervals cover approximately the sizes of the dots in the figure. As a rule of thumb, a difference between the early and late cohorts is statistically significant at conventional levels insofar as the data points in the figure are clearly distinguishable; see the note to Figure 4 for details.

Panels (a) and (b) show average earnings rank in own generation (based on the sum of earnings obtained between ages 28-40), and panels (c) and (d) display their corresponding share of total earnings for the whole cohort. For both sons and daughters, we see patterns of relatively high economic mobility. Regardless of family background, the expected own vigintile rank is somewhere between 8 and 14, and each class' expected share of total earnings is between 4.0 and 6.5 percent throughout the period covered by our data. This is apparently not very far from perfect mobility (no association between class background and own outcome), in which case the expected own vigintile rank would have been 10.5 for everyone, and the expected earnings share for all classes would have been exactly 5 percent. It implies that regardless of the starting point, it takes on average just two generations to end up around the middle of the distribution. However, there appears to have been a decline in mobility, particularly in the form of more persistence at the bottom of the class background distribution. It is also clear that the mobility patterns of daughters have become much more similar to that of sons.

The four lower panels in Figure 4 illustrate how the changes in earnings ranks and shares are related to changes in employment patterns. We have defined a person as employed in the age 28-40 period if average annual earnings during these years exceeded approximately 1/3 of average full-time-full-year earnings in Norway.¹¹ For men, panel (e) illustrates that employment rates have declined somewhat irrespective of social background, but they have declined more the lower is the parental class rank. For sons from the lowest classes, the employment rates have dropped by almost 10 percentage points, compared to less than a one-point decline for the upper classes. For women, the pattern is quite different, and the daughters' employment rates have increased in all classes; see panel (f). Again, we see indications of convergence between the male and female mobility patterns. And for both sons and daughters, it is notable that there has emerged a quite conspicuous class gradient in employment, which for men was much less pronounced for those born in the 1950s. The steeper class gradient in employment primarily reflects that the lower ranked earnings outcomes to an increasing extent have become dominated by non-employed individuals, and not that class mobility has changed *per se*. However, at the bottom of the class distribution, we would have seen a considerable decline in employment levels even if employment rates had remained constant at all parts of the outcome distribution. Based on the counterfactual assumption that employment rates were indeed constant at all outcome rank levels, we can actually calculate that the decline in rank alone can explain 35 % of the of the employment drop in the first vigintile, 27 % of the fall in the second vigintile, and 17 % of the fall in the third vigintile. For the other vigintiles, the changes in rank mobility have only had negligible effects on employment.

Panels (g) and (h) further illustrate the class distribution of employment by plotting the share of total employment accounted for by each class. For men, it then becomes clearer that the class gradient in employment actually has become steeper throughout the class distribution, while for women, the class gradient has become less steep for all classes above the seventh vigintile.

¹¹ More precisely, we require average annual earnings during these years to exceed 2 times the so-called Basic Amount (BA) in the Norwegian pension system, which is adjusted each year approximately in line with the general wage growth. This definition of employment implies that it can be satisfied by having a very weak attachment to the labor market over many years or by having a strong attachment over just a few years.



Figure 4. Indicators of offspring earnings and employment by economic class.

Note: The horizontal lines at 10.5 (in panels (a) and (b)) and 0.05 (in panels (c), (d), (g), and (h)) are the *perfect mobility lines*. Economic class (vigintile rank from 1 to 20) on the horizontal axis is assigned based on the sum of parents' earnings obtained during their respective ages 52-58. Offspring earnings are measured as the sum of own earnings during age 28-40. Both parental and offspring earnings include self-employment earnings. Employment (panels (e)-(h)) is defined as having average annual earnings during age 28-40 above a level corresponding to approximately 1/3 of average full-time full-year earnings in Norway. Based on a nonparametric bootstrap with 120 trials, we estimate that the shifts in the reported statistics from the 1952-57 to the 1970-75 birth cohorts are significantly different from zero at the 5% level for the following vigintiles: Panel (a): 1-2,4-5,8-10,18,20; panel (b): 1-6,10-20; panel (c): 1-3,9-10,15-16,20; panel (d): 1-3,7-14,16,19-20; panel (e): 1-20; panel (f): 1-20; panel (g): 1-4,7,9-20; panel (h): 4,6-13,16-20.

Figure 5 displays relative earnings levels, conditional on employment (average earnings among the employed in each vigintile divided by the corresponding average for all employed). Again, we find indications of somewhat lower relative earnings levels at the bottom of the class distribution. For men, there are otherwise only small changes, whereas for women, we see a steeper class gradient throughout the class distribution. Taken together, Figures 4 and 5 suggest that the declining earnings ranks and earnings shares of persons born into the lowest economic classes have resulted from a combination of lower employment and lower earnings levels conditional on employment. While lower employment plays a key role behind the falling-behind of lower class men, lower relative earnings – possibly related to relatively more part-time work – explain the falling-behind of lower class women.



Figure 5. Relative earnings conditional on employment. By class background.

Note: Relative earnings are conditional on employment (see note to Figure 4) and show the average earnings level during age 28-40 for the employed population in each class divided by the average earnings level for all employed workers in the cohort. Based on a nonparametric bootstrap with 120 trials, we estimate that the shifts in the reported statistics from the 1952-57 to the 1970-75 birth cohorts are significantly different from zero at the 5 % level for the following vigintiles: Panel (a): 1-2; panel (b): 1-6,14-20.

In order to examine the time trends in more detail we define a few summary statistics that can be computed for each annual birth cohort. We have already introduced the intergenerational rank correlation (IRC), i.e., the correlation between the parents' and the offspring's rank in their respective cohorts' earnings distributions. Another intuitively appealing summary measure is the average number of classes crossed, i.e., the absolute difference between parent's and offspring's economic position in their respective generations (Bartholomew, 1982), possibly normalized by the average number of classes crossed in the hypothetical case of perfect mobility. Let q_{po} be the fraction of offspring born into class p who themselves end up in class o . With N classes (quantiles), our intergenerational rank mobility (IRM) measure takes the form:

$$IRM = \frac{\sum_{p=1}^N \sum_{o=1}^N q_{po} \frac{1}{N} |o - p|}{\sum_{p=1}^N \sum_{o=1}^N \frac{1}{N^2} |o - p|}, \quad p = 1, \dots, N, \quad o = 1, \dots, N,$$

where the denominator measures the average offspring-parent class difference under perfect mobility. In our case, with $N=20$ (vigintiles), this difference will on average be 6.65 classes.

A useful feature of the IRM measure is that it can easily be adapted to examinations of mobility in particular parts of the class distribution. Given that the more interesting changes in mobility patterns appear to have happened at the tails of the social background distribution, we present two statistics designed to measure mobility out of the bottom and top vigintiles, respectively. We define intergenerational bottom rank mobility (IBRM) as the number of classes moved, given an initial position in the lowest vigintile, and intergenerational top rank mobility (ITRM) as the number of classes moved, given an initial position in the highest vigintile (in both cases relative to the case of perfect mobility, which for the two extreme vigintiles implies that the average number of classes moved is 9.5).

In Figure 6, panels (a)-(d), we show how overall earnings rank mobility developed over the 1952 to 1975 birth cohorts. For sons, we find that overall earnings mobility – as measured by IRC and IRM – has been relatively stable, with a slight decline in mobility between the cohorts born in the early 1950s and mid-1960s, and then an increase afterwards. The intergenerational rank correlation has hovered around 0.22-0.24 throughout the period, whereas the average number of classes crossed has been stable at around 85.0 % of what would be associated with perfect mobility. Our findings at this point are somewhat at odds with Pekkarinen et al. (2007), who report completely stable rank-rank correlations for sons at 0.19-0.20 for the same time period (based on father earnings only). For daughters, we have apparently seen a considerable decline in mobility. The rank correlation has increased from around 0.17 to 0.25, and the average number of classes crossed has declined from almost 90 to 84 % of what would be associated with perfect mobility. It is remarkable that for the last cohorts entering our analysis, the degree of rank-rank mobility for daughters is actually lower than for sons. Our estimates of rank correlations are similar to the 0.23 and 0.22 estimates reported for men and women, respectively, by Bratberg et al. (2017) on the basis of household earnings for offspring in 1996-2006 and for parents in 1978-1980.

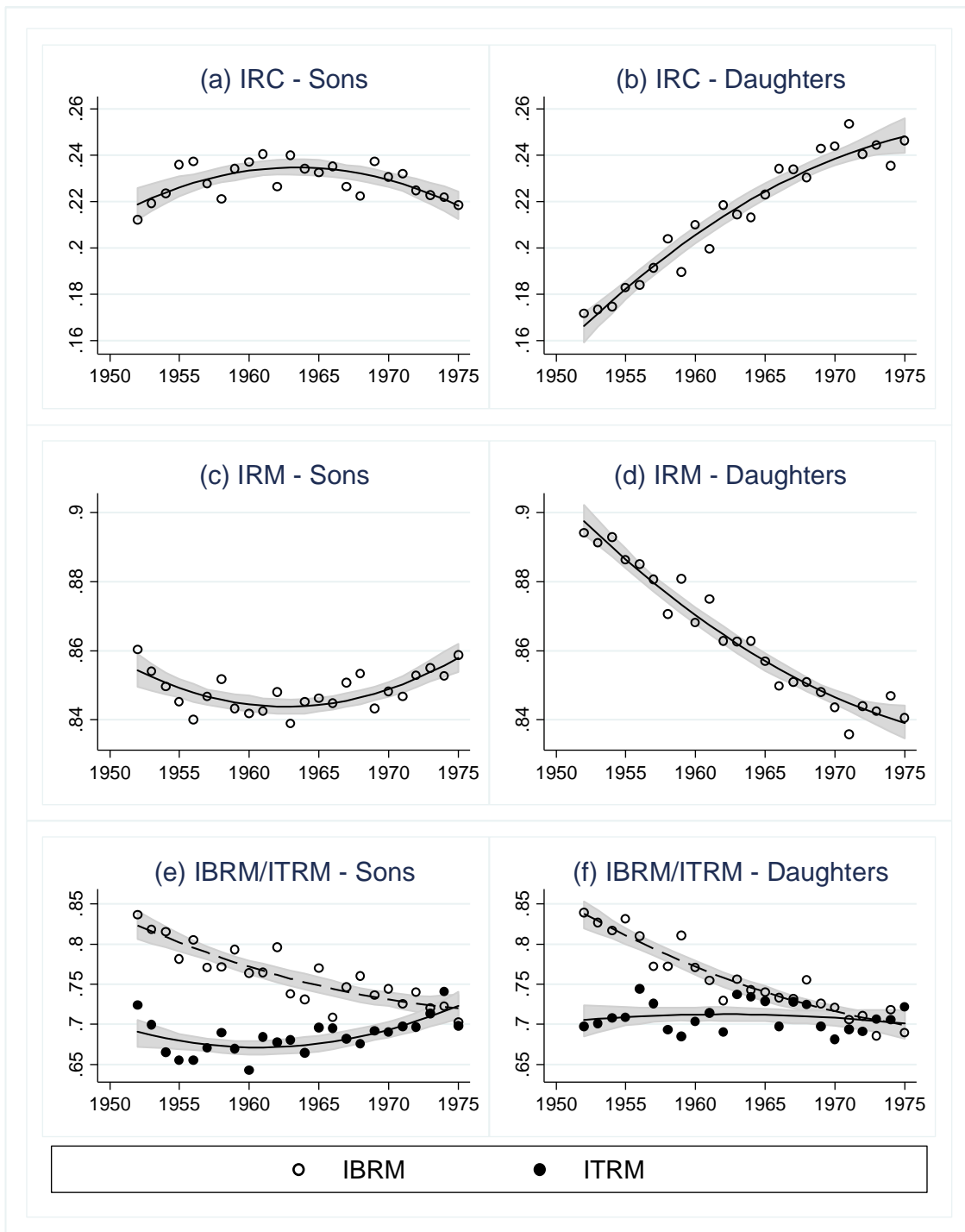


Figure 6. Trends in intergenerational earnings rank mobility.

Note: Panels (a) and (b) display the intergenerational rank correlation (IRC) by birth cohort. Panels (c) and (d) show the intergenerational rank mobility (IRM), and panels (e) and (f) show the intergenerational bottom rank mobility (IBRM) and intergenerational top rank mobility (ITRM). The trend lines are estimated as a quadratic function of time, and the shaded areas mark the 95 % point-wise confidence interval for these lines (based on a nonparametric bootstrap with 120 trials).

In the lower part of Figure 6 (panels (e) and (f)), we present the trends in bottom (upwards) and top (downwards) class mobility. It is evident that there has been a considerable negative development in bottom class mobility for both men and women. At the top of the class distribution, on the other hand, mobility appears to have increased slightly among sons. It is also notable that for both men and

women, there has been a conspicuous convergence in the rates of bottom and top mobility; while the upwards mobility out of the bottom class was much higher than the downwards mobility out of the top class for offspring born in the 1950s, the two mobility statistics have become virtually indistinguishable for offspring born in the 1970s.

Given the important role that employment rates appear to play for the development of economic mobility, we plot in Figure 7, the employment rates and earnings shares for the bottom and top classes, respectively, birth-cohort by birth-cohort. The pattern displayed for sons in panel (a) confirms that the declining employment rate at the bottom of the class distribution is the result of a continuous and apparently stable trend, accompanied by a corresponding trend in the earnings share (panel (c)). For daughters, there has been a stable rise in low class employment (panel (b)), again accompanied by a trend in the direction of declining earnings shares (panel (d)).

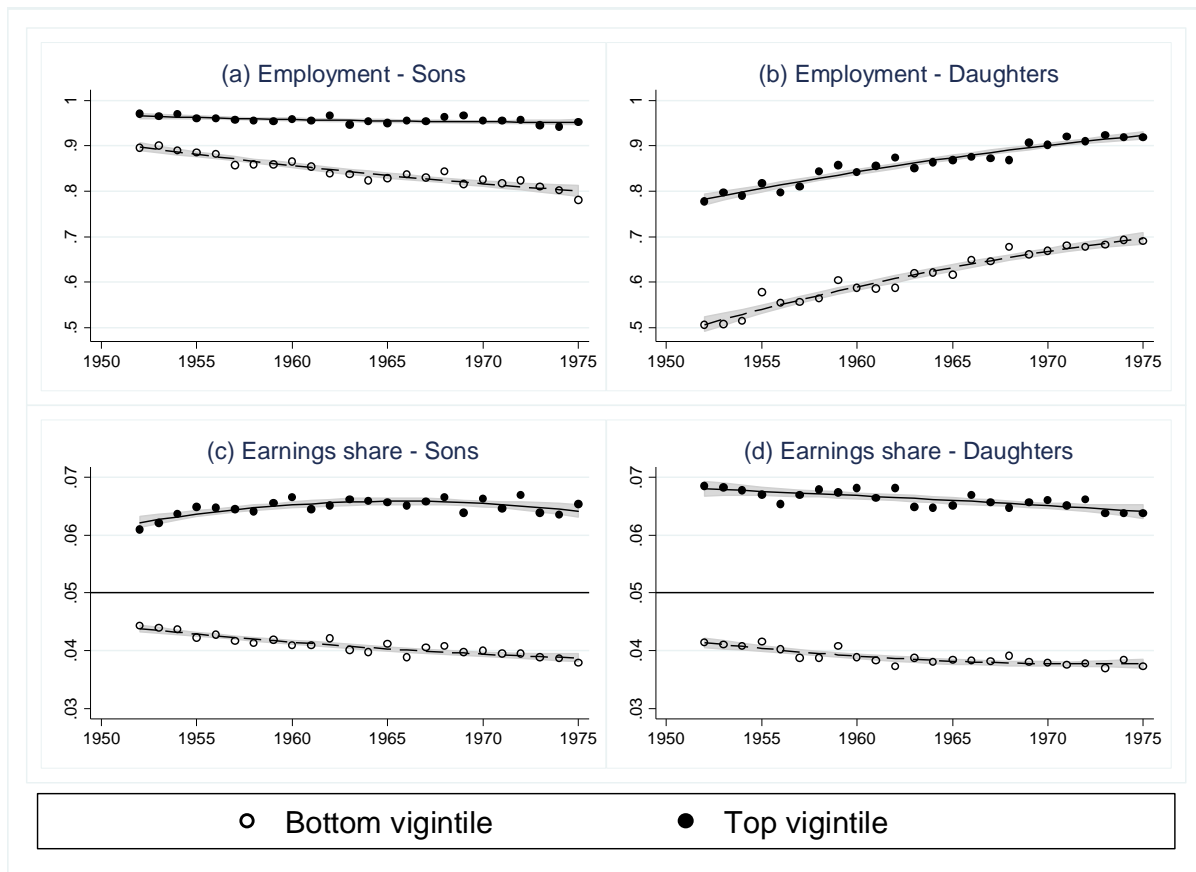


Figure 7. Trends in employment rates for offspring from the bottom and top parental classes (vigintiles).
 Note: Panels (a)-(d) show years of noncompulsory education (NCE), which include secondary (high school) and tertiary (college/university) education. Panels (e)-(h) show years of tertiary education only. The trend lines are estimated as a quadratic function of time, and the shaded areas mark the 95 % point-wise confidence interval for these lines (based on a nonparametric bootstrap with 120 trials).

As we pointed out in the previous section, it is possible that changes in the composition and/or timing (in the lifecycle) of parental earnings will have altered the social class interpretation of a ranking based on total age 52-58 parental earnings. If so, our identified trends in earnings rank persistence/mobility, e.g., as captured in Figure 6, may reflect trends in the appropriateness of our class assignment algorithm rather than in genuine intergenerational mobility. To assess this concern, we end this subsection by presenting trends in a mobility/persistence measure that does not rely on parental earnings at all, namely the correlations and average earnings class differences observed between pairs of brothers and sisters. In this exercise, we of course lose a lot of information, as we can only use families with at least two sons or two daughters, respectively. However, the association between earnings outcomes of siblings conveys potentially valuable information about trends in the influences of family background, irrespective of a potentially fluid class concept. It is a broader measure of social background than the intergenerational one, as it incorporates all conditions shared by siblings, also those uncorrelated to parental earnings; see, e.g., Solon (1999), Österbacka (2001), Björklund et al. (2002), Björklund et al. (2009), and Björklund and Jäntti (2012).

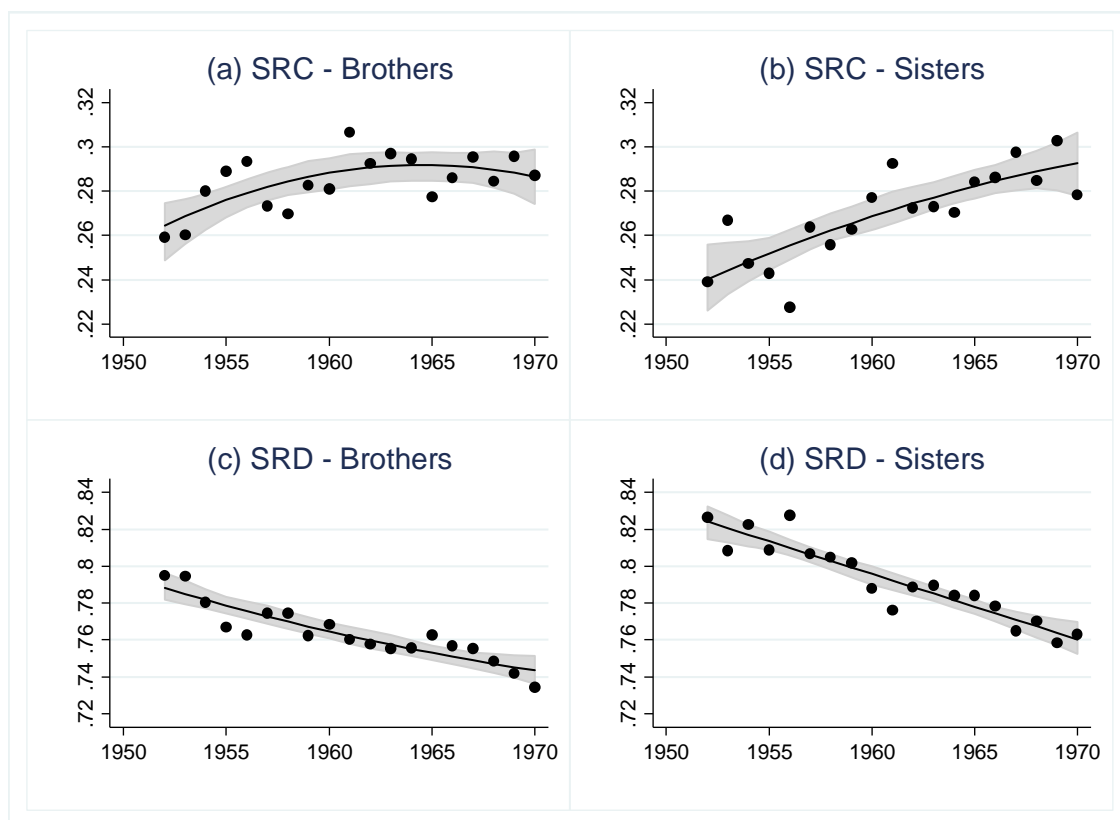


Figure 8. Earnings associations between brothers and sisters. Sibling rank correlations (SRC) and average sibling rank distance (SRD). By birth cohort.

Note: The rankings are made for each birth-year separately and based on total earnings age 28-40. The years on the horizontal axis denote the birth-year of the first-born sibling. Only siblings born within five years are included; see Table 1 for overview of the data. The trend lines are estimated as a quadratic function of time, and the shaded areas mark the 95 % point-wise confidence interval for these lines (based on a nonparametric bootstrap with 120 trials).

The results are illustrated in Figure 8. They are not directly comparable to the summary statistics presented in Figure 6, as they compare brothers and sisters born in different years. In Figure 8, we have assigned the respective statistics to the birth year of the first-born sibling, allowing for up to a five-year difference. Although the variations from year to year do not follow exactly the same pattern as in the upper four panels of Figure 6, the trends look similar. For men, we find indications of a mildly declining economic mobility for sons born between the early 1950s and the mid-1960s. Given the shorter time window available for the brother correlations, it is not clear, however, that we can observe the same increase in mobility afterwards, although we see some signs in this direction in panel (a). For daughters, we again uncover an unequivocal pattern of declining economic mobility.

4.2 Education

We now turn to the trends in the influence of class background on one of the most likely *mediators* behind intergenerational earnings mobility, namely educational attainment. While education obviously has the potential for affecting earnings outcomes, it can also be viewed as important quality-of-life indicator in its own right, as it gives access to interesting jobs, influential networks, and high social status. Hence, the developments of class gradients for education outcomes give important additional information about trends in the overall degree of inequality of opportunities. Since education can be recorded somewhat earlier in the lifecycle than the earnings measured used in the previous subsection, it also facilitates examination of a larger number of birth cohorts. To assess educational outcomes, we record for each individual whether or not they had achieved an upper secondary, bachelor's, and master's degree, respectively, at age 28. In addition, we count the numbers of years of education exceeding compulsory education (secondary and tertiary) normally required to obtain each grade. The latter makes it possible to examine how the total number of non-compulsory education years is distributed within each birth cohort.

Figure 9 shows educational attainment by class background for three waves of birth cohorts, born in 1952-57, 1970-75, and 1980-85, respectively. Educational attainment has been raised in all classes, but it has been raised most in the central parts of the class distribution; i.e., for the middle classes. Panels (a) and (b) first show that upper secondary education has become much more common, and also less reliant on class background. This development is strongly related to the expansion of the supply of secondary education, which culminated in 1994 with a reform making access to upper secondary education a legal entitlement.

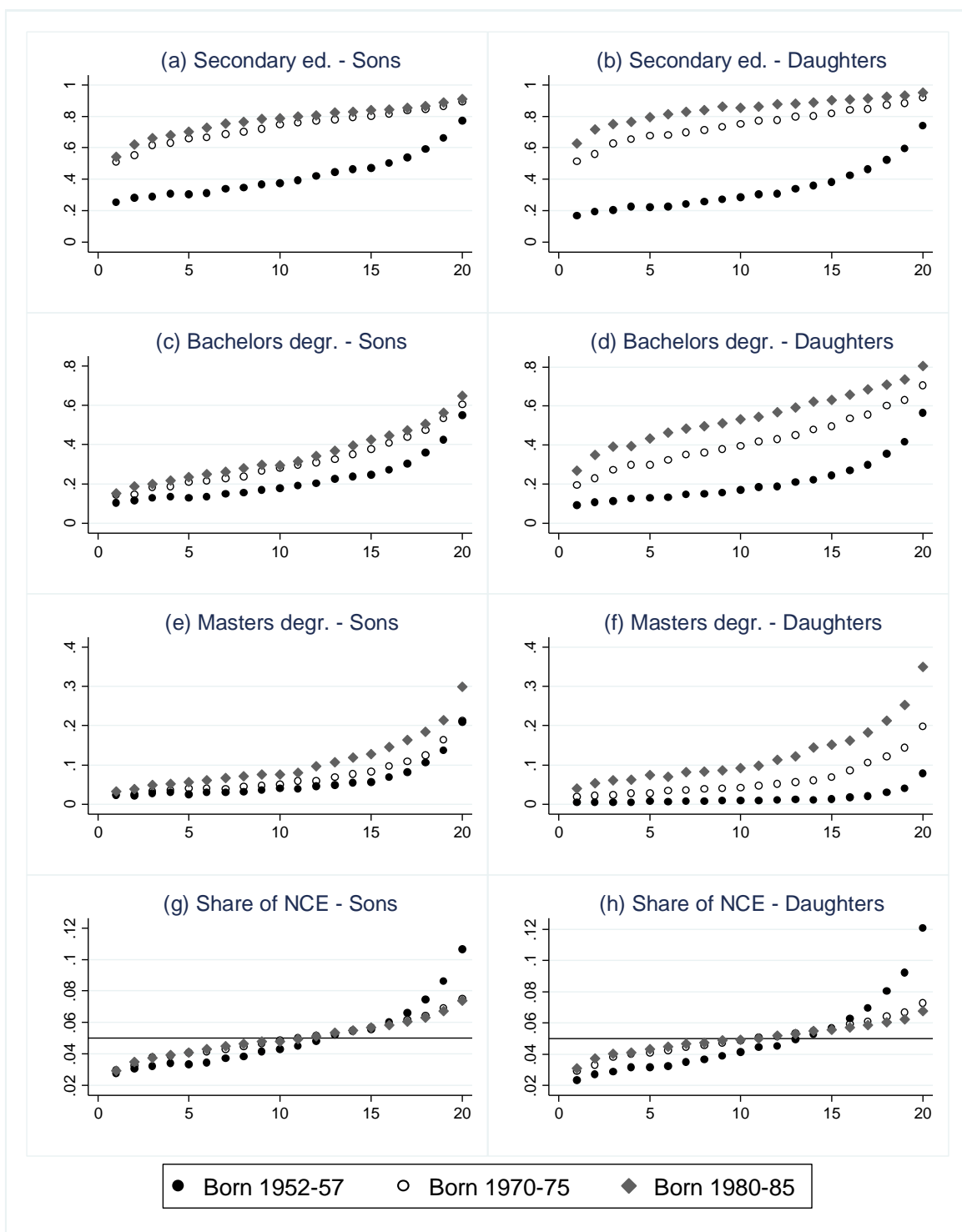


Figure 9. Indicators of offspring educational attainment by economic class.

Note: Offspring education is measured at age 28. Panels (a)-(f) show the fractions in each class vigintile having obtained at least an upper secondary, bachelor's, or master's degree, respectively, whereas panels (g)-(h) show the share of total non-compulsory education year for each cohort that are accounted for by each class vigintile. Based on a nonparametric bootstrap with 120 trials, we estimate that the shifts in the reported statistics from the 1952-57 to the 1970-75 birth cohorts are significantly different from zero at the 5% level for the following vigintiles: Panel (a): 1-20; panel (b): 1-20; panel (c): 1-20; panel (d): 1-20; panel (e): 3-7,9-14,16,18-20; panel (f): 1-20; panel (g): 1-20; panel (h): 1-20. The shifts from the 1970-75 to the 1980-85 birth cohorts are significant for the following vigintiles: Panel (a): 1-20; panel (b): 1-20; panel (c): 2,3-9,11-20; panel (d): 1-20; panel (e): 1-20; panel (f): 1-20; panel (g): 1-20; panel (h): 1-20

There has also been a rise in tertiary education (panels (c)-(f)), particularly in the form of more bachelor's degrees among middle class daughters (panel (d)). And while a considerable class gradient remains in the distribution of bachelor's degrees, the gradient has become much steeper in the distribution of master's degrees, except at the very top of the class distribution (panels (e) and (f)). The latter development reflects that for the 1950-cohorts, master's degrees were almost exclusively allocated to offspring from the upper five vigintiles of the class distribution. As the supply of tertiary education expanded for later cohorts, master's degrees also became available to offspring from the middle classes, resulting in a much more linear relationship between class background and higher education. Nevertheless, as illustrated in panels (g) and (h), the overall distribution of education years has become less class-determined. For example, while the upper class vigintile "consumed" 11-12 percent of all non-compulsory education-years in the early 1950s cohort, their share fell to around 7 percent for those born 20-30 years later.

Figure 10 presents some summary measures for the development of the association between educational attainment and class background, cohort by cohort. Panels (a) and (b) first show that the correlation coefficients between class background and the fulfilment of upper secondary education have declined quite monotonously over time for both sons and daughters. In contrast, the correlation coefficients between class background and the tertiary education outcomes have increased; see panels (c)-(f). This is particularly the case for master's degrees among daughters (panel (f)). As a result of all these developments, we see in panels (g) and (h) that the share of education years obtained by the very top vigintile has declined sharply, while the share obtained by the very bottom vigintile has remained more or less constant (sons) or increased slightly (daughters).

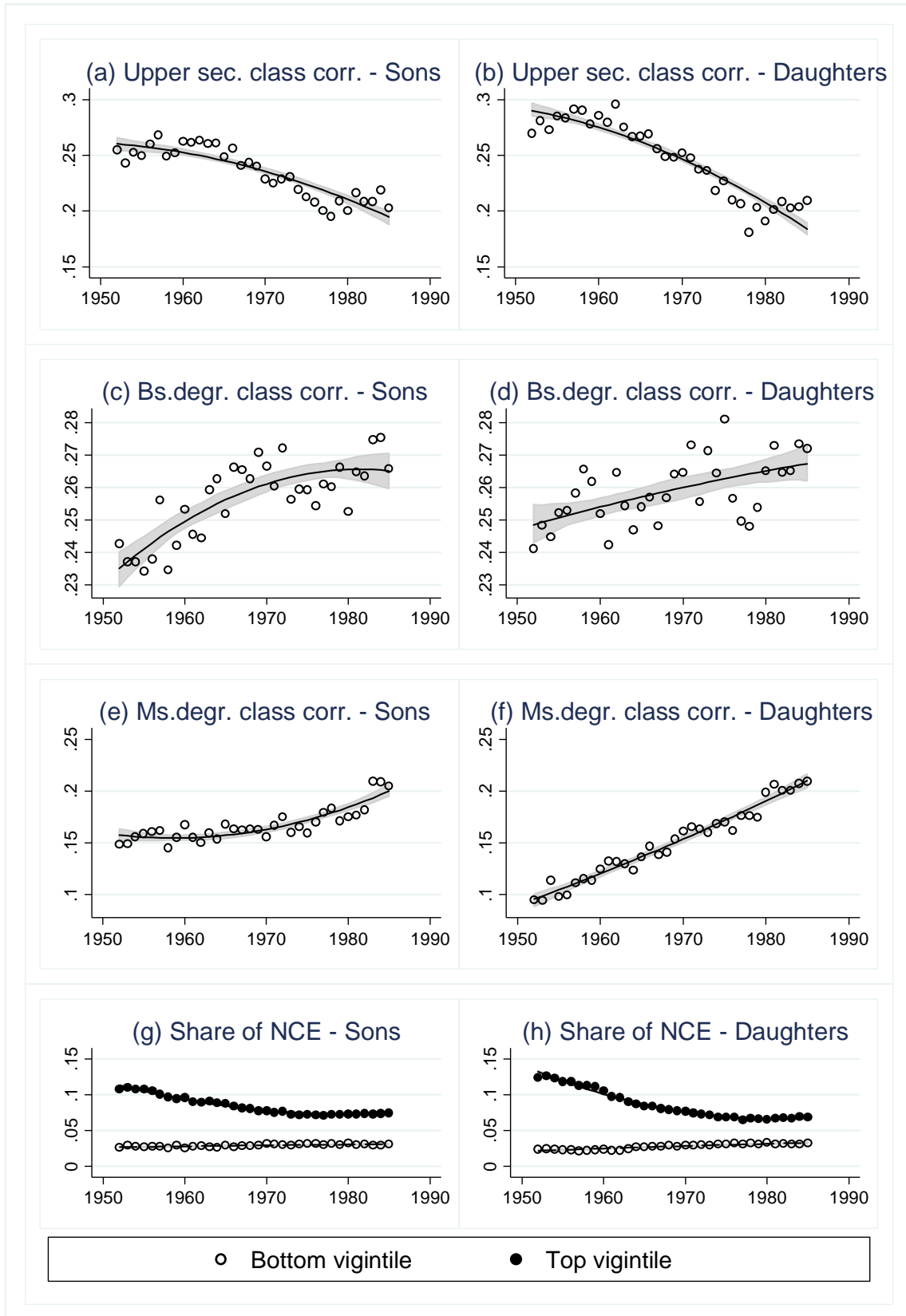


Figure 10. Trends in the relationships between educational attainment and class background.

Note: Panels (a)-(f) show for each birth cohort correlation coefficients between indicators for completion of upper secondary, bachelor's, and master's degrees, respectively and class quintile, and panels (g)-(h) show the fraction of each cohort's total number of education years accounted for by the lower and upper quintile, respectively. The trend lines are estimated as a quadratic function of time, and the shaded areas mark the 95 % point-wise confidence interval for these lines (based on a nonparametric bootstrap with 120 trials).

4.3 Disability program participation

Good health is an essential part of a good life, and probably also an important ingredient of a successful labor market career. Hence, in order to examine changes in the association between class background and the quality of life more generally, we now consider the class gradient in disability program participation. The disability insurance programs are by far the largest social insurance programs in Norway, covering roughly 15 percent of the working-age population at any time. The eligibility requirement is that a person's work capacity is reduced by at least 50 percent due to a health problem, and this needs to be certified by a physician and verified by the social security administration; see Fevang et al. (2016) for details. More specifically, we define a person as disability program participant at age 40 if at least one claim of (temporary or permanent) disability insurance was made during the calendar year of the 40th birthday. The reason why we focus on claims made at age 40 (and not in the years before) is that these are the claims that can be identified in a perfectly symmetric fashion for all the birth cohorts entering our analysis on the basis of administrative register data (as we do not have information about claims made before 1992).

Figure 11 presents the developments of disability program participation by class background. Panels (a) and (b) first show that there has been a considerable increase in disability program participation from the 1950s to the 1970s birth cohorts, and for both sons and daughters, it is evident that the increase is larger the lower is the economic class background. As a result, the shares of the disability program participants that come from the lower classes have increased sharply (panels (c) and (d)). The correlation between poor health and economic class has also gradually become more negative (panels (e) and (f)). And while the bottom class has experienced a dramatic rise in disability program participation, the top class has experienced almost no increase at all (panels (g) and (h)). Hence, there is no doubt that there has been a sharp increase in the class gradient of disability program participation.

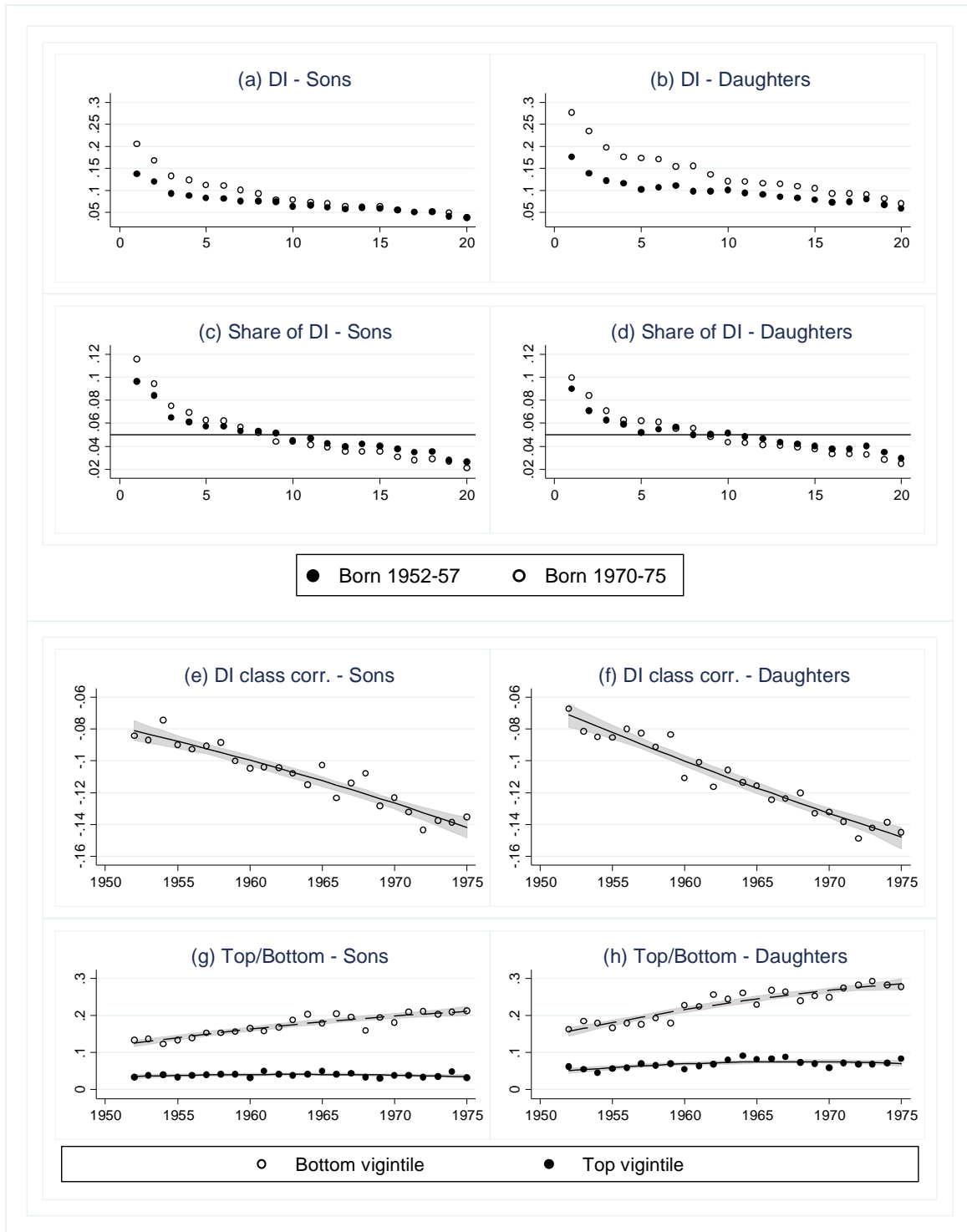


Figure 11. Disability program participation by class background and birth year.

Note: Disability program participation (DI) is set to unity if a disability insurance benefit was received during the calendar year of the 40th birthday. Panels (a) and (b) show disability program participation rates by class background. Panels (c) and (d) show the fraction of each cohorts disability program participants accounted for by each class. Panels (e) and (f) show the correlation between disability program participation and class background by birth-year. Panels (g) and (h) show disability program participation rates for the top and bottom class vigintiles by birth-year. The trend lines are estimated as a quadratic function of time, and the shaded areas mark the 95 % point-wise confidence interval for these lines (based on a nonparametric bootstrap with 120 trials). The shifts in the reported statistics from the 1952-57 to the 1970-75 birth cohorts are significantly different from zero at the 5% level for the following vigintiles: Panel (a): 1-8,10,12-13,19; panel (b): 1-20; panel (c): 1-6,9,11,13-18,20; panel (d): 1-6,8,10-12,16-20.

4.4 Family formation

For many persons, companionship is an important element of life quality. Finding a partner may thus be a goal in its own right, but, depending on the economic status of the partner, also a way of ensuring the possibility of high consumption. Through household specialization, it may also boost the labor market career, at least for one of the partners. Economic class may influence a person's attractiveness in the marriage market, and thus affect both the probability of finding a mutually acceptable match and the economic status of a partner.

Figure 12 presents the development of the association between the event of finding a partner and economic class background. Finding a partner is here defined as having been married at least once or obtained a child before age 40. We identify a considerable class gradient in the probability of finding a partner for men (panel (a)), but not for women (panel (b)). This is in line with theories of hypergamy, suggesting that women on average give higher priority to a potential spouse's earnings capacity than do men (Hitsch et. al., 2010; Almås et al., 2017). In accordance with this theory, it is also clear that the marital class gradient for men has become steeper over time (panel (c)), in tandem with the gradients in economic outcomes. The correlation between economic class and partner matching propensity has been relatively stable for both men (panel (e)) and women (panel (f)), however, and, as shown in panel (g), it is particularly at the bottom of the class distribution that we see considerable declines in men's chances of finding a partner.

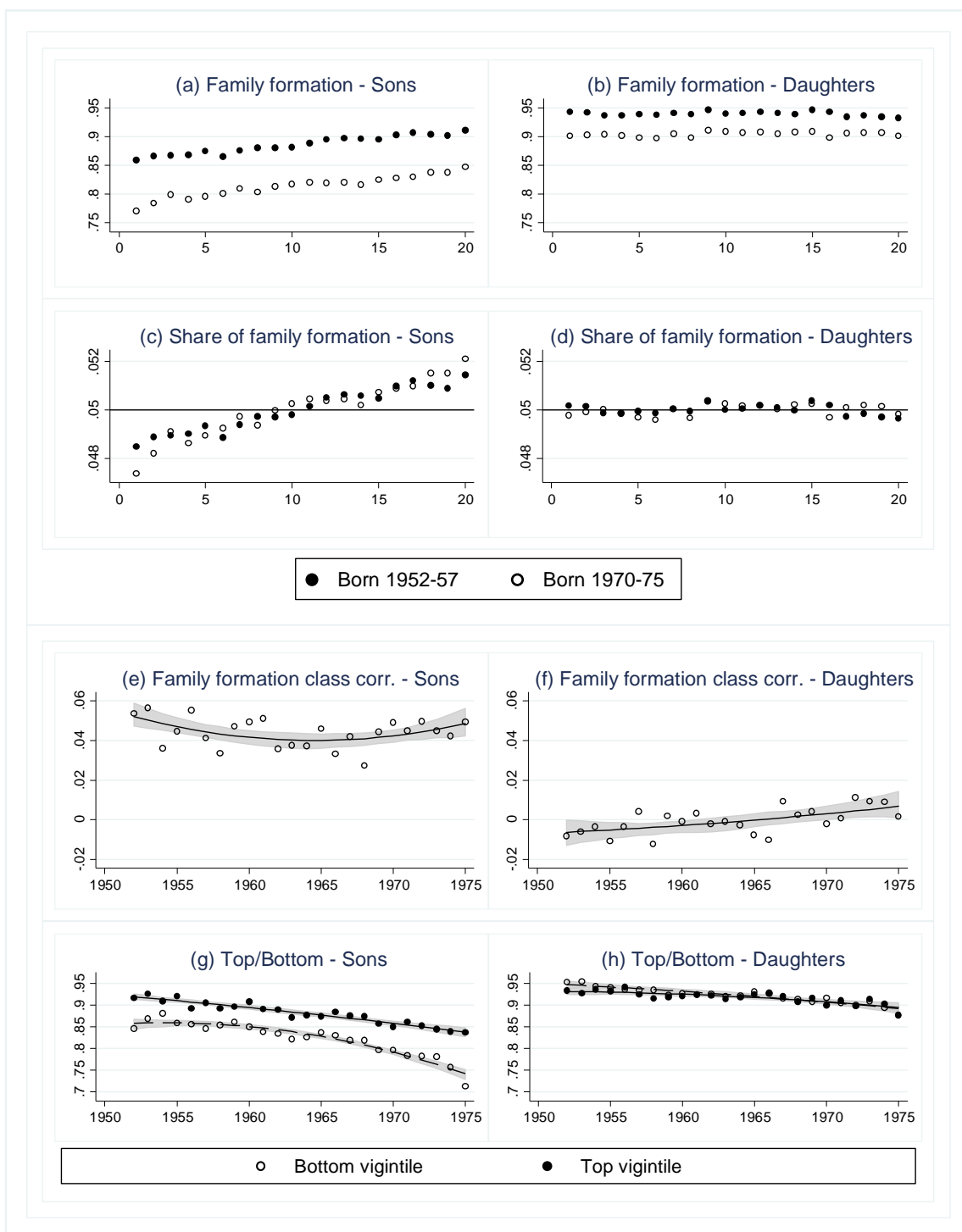


Figure 12. *The probability of finding a partner by class background and birth year.*

Note: Finding a partner is a dichotomous variable set to unity if a person has (ever) married or obtained a child before the age of 40. Panels (a) and (b) show partnership rates by class background. Panels (c) and (d) show the fraction of each cohort's partnered offspring accounted for by each class. Panels (e) and (f) show the correlation between finding a partner and class background by birth-year. Panels (g) and (h) show partnership rates for the top and bottom class vigintiles by birth-year. The trend lines are estimated as a quadratic function of time, and the shaded areas mark the 95 % point-wise confidence interval for these lines (based on a nonparametric bootstrap). The shifts in the reported statistics from the 1952-57 to the 1970-75 birth cohorts are significantly different from zero at the 5 % level for the following vigintiles: Panel (a): 1-20; panel (b): 1-20; panel (c): 1,19; panel (d): 16.

For those who do find a partner, it is also possible to examine the *marital rank distance*, defined as the average difference between his and hers class background. This has been done in Markussen and Røed (2016) for all marriages established between 1993 and 2013, based on a similar parental class ranking strategy as the one used in the present paper. In line with existing evidence (e.g., Fernandez et al., 2005; Browning et al., 2014) they find indications of homogamy, in the sense that pairs tend to consist of persons with similar class background (with his background slightly better than hers). The degree of marital mobility is high, however, with the average rank difference equal to approximately 90 % of the perfect mobility case.

4.5 Mortality

Perhaps the most fundamental quality-of-life indicator we can think of is *being alive at all*. A steep social gradient in longevity is an established fact (Marmot, 2004), and recent evidence from the U.S. has indicated that differences in life expectancy across income groups have increased over time (Chetty et al., 2016). However, since individuals' income and health are jointly determined endogenous outcomes, this does not by itself provide evidence regarding the impact of family background. To shed light on possible changes in the class gradient of mortality in Norway, we thus examine changes in the pattern of mortality by parental economic class. In our analysis so far, we have conditioned on survival (and residency in Norway) until age 40. To examine mortality as an outcome, we remove this condition, and include in the analysis population all native born Norwegians who died between the age of 18 and 40 (our data do not allow us to examine child mortality in a consistent way). We then recalculate the class ranking based on this extended population, and define death by age 40 as the outcome of interest. On average, around 2-3 % of the men and 1 % of the women die between age 18 and 40. By examining mortality at such a low age, we of course lose many of the potentially most important sources of a class gradient in longevity, as mortality profiles at much higher ages will dominate this outcome. However, we may be able encapsulate some class-related sources of early death, particularly those caused by risky behaviors.

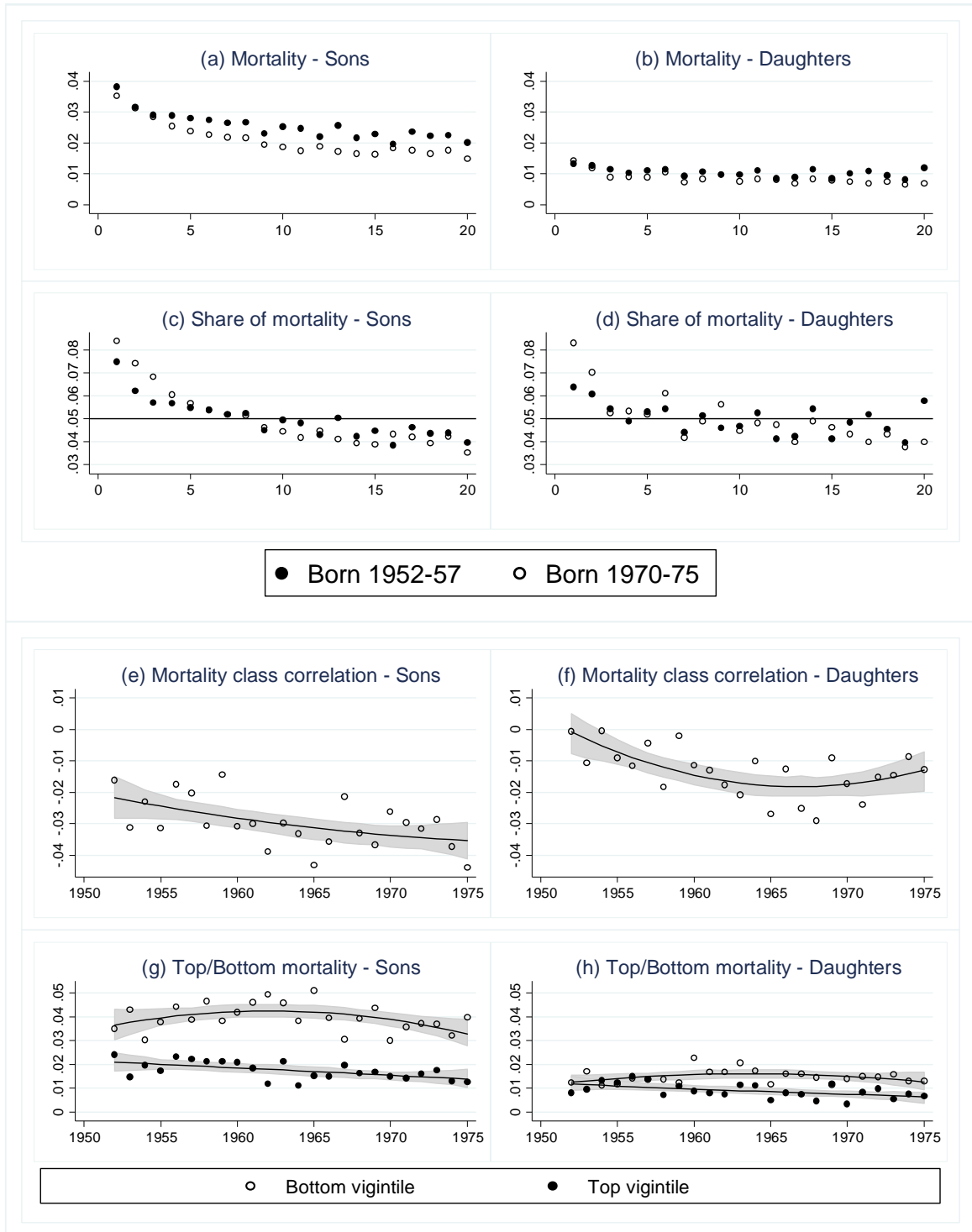


Figure 13. Mortality between age 18 and 40 by class background and birth year.

Note: Mortality is a dichotomous variable set to unity if a person died between the age of 18 and 40. Panels (a) and (b) show mortality rates by class background. Panels (c) and (d) show the fraction of each cohort's total number of deaths accounted for by each class. Panels (e) and (f) show the correlation between mortality and class background by birth-year. Panels (g) and (h) show mortality rates for the top and bottom class vigintiles by birth-year. The trend lines in panels (e)-(h) are estimated as a quadratic function of time, and the shaded areas mark the 95 % point-wise confidence interval for these lines (based on a nonparametric bootstrap). The shifts in the reported statistics from the 1952-57 to the 1970-75 birth cohorts are significantly different from zero at the 5 % level for the following vigintiles: Panel (a): 8,10-11,13-15,17-20; panel (b): 17,20; panel (c): 1,3; panel (d): 20.

The results are presented in Figure 13. Panels (a) and (b) first show that there is a class gradient in mortality, and that the gradient has become slightly steeper for the later birth cohorts. This is further illustrated in panels (c) and (d), where we report each vigintile's fraction of the overall number of deaths by age 40. For both men and women, the lower vigintiles account for around 7-8 percent of the deaths, and this share is higher for the later cohorts. Panels (e) and (f) show the correlation between the mortality rate and class background cohort-by-cohort. The negative correlation is more pronounced for men than for women, and it has become a bit stronger over time. Finally, panels (g) and (h) show how the mortality rates have developed over time for the top and bottom vigintiles. While we see a relatively parallel trend for men, there are signs of increasing disparities between women in the top and bottom vigintiles.

5 Why are lower class offspring falling behind?

The results we have presented so far suggest that there has been a gradual decline in upward economic mobility for those born into the poorest families. From a policy perspective, it is of interest to know whether this development has arisen through changes in the relationship between class background and cognitive ability, through changes in the economic consequences of cognitive ability as such, or through changes in class-related differences in economic opportunities, given cognitive ability. In this section, we first seek to distinguish between the roles of abilities and opportunities by using cognitive ability test scores for sons, administered by the Norwegian Armed Forces. In particular, we seek to identify changes in the association between class background and cognitive ability, as well as in the consequences that cognitive ability has for economic outcomes. In this exercise, we also examine the interplay between cognitive ability and the development of the "knowledge economy", characterized by rapidly increasing educational standards in the labor market. We then move on to a closer inspection of potential changes in the role that neighborhoods may (or may not) have played in shaping economic mobility patterns. Again, we are interested both in studying whether neighborhoods have become more (or less) class segregated over time, and in studying whether the effects of growing up in poor versus rich neighborhoods have changed.

5.1 The role of cognitive ability

Before compulsory military service, all Norwegian men undergo an assessment of suitability around age 18-19. From 1969/70 (i.e., for the cohorts born after 1950), this assessment has included intelligence (IQ) testing. All test-takers receive an integer score running from 1 to 9, which is a composite of three tests, on arithmetic, word similarities and pattern recognition. Since the scale has been used slightly differently in different periods, we have made a corresponding rescaling of scores for cohorts

born before 1961, and then divided the scores into three *consistently defined* levels, denoted low IQ, middle IQ, and high IQ, respectively. The middle group then encompasses approximately 60 % of the population, whereas the other two categories comprise 20 % each. These IQ indicators are of course both imperfect and noisy measures of earnings-related personal traits. However, as we show below, they are highly correlated with economic outcomes, and may thus shed some additional light on the potentially changing role that such traits may have played in accounting for intergenerational persistence.

Figure 14 shows how the distribution of cognitive ability across economic class backgrounds has developed over birth cohorts. Panels (a) and (b) first present each class vigintile's share of the low- and high IQ populations, respectively, for cohorts born in 1952-57, 1970-75, and 1980-85. It is clear that there is indeed a strong class gradient in cognitive ability. While the bottom class vigintile accounts for roughly 8 % of the low IQ population, it accounts for less than 3 % of the high IQ population. By contrast, the top class accounts for 9-12 % of the high IQ population, but less than 3 % of the low IQ population. It is also clear that the class gradient in IQ has been remarkably stable with the exception that the top class' share of the high IQ group has declined from 12 to around 9 %. Given that cognitive ability measured at age 18/19 has been shown to be somewhat affected by education (Brinch and Galloway 2012; Carlsson et al., 2015), it is natural to interpret the decline in the top vigintile's ability premium as being a result of the considerable decline in their corresponding education premium; confer Figure 10.

Panels (c) and (d) present the correlations between class background and dummy variables indicating belonging to the low and high IQ groups, respectively, cohort by cohort. If anything, these graphs indicate that the class gradient in cognitive ability has declined over time, as the correlation between class background and low IQ has become less negative whereas the correlation between class and high IQ has become less positive.

The slightly weaker relationship between class background and offspring ability, revealed in Figure 14, clearly suggests that there has not been a drift toward meritocracy in the parent generations; as such a trend would most certainly have spilled over to the offspring generations.

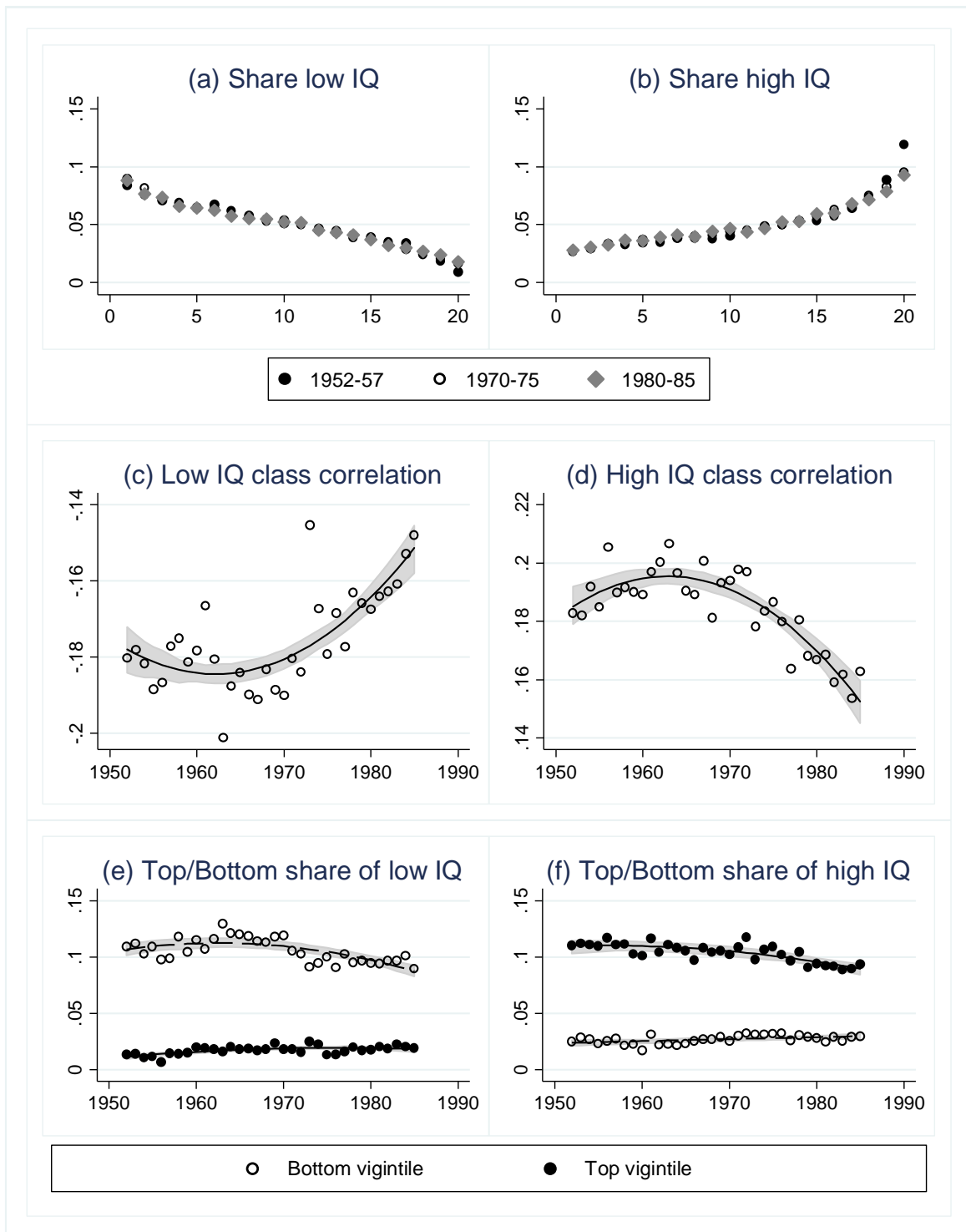


Figure 14. Cognitive ability by class background and birth year (men only)

Note: Cognitive ability is measured at enrolment to compulsory military service around age 18-19, and classified as low, middle, or high. Panels (a) and (b) show the shares of low and high ability offspring in each cohort accounted for by each class. Panels (c) and (d) show the correlation between class background and the likelihood of belonging to the groups of low and high ability, respectively. Panels (e) and (f) show the shares of low-ability and high-ability offspring in the bottom and top class vigintiles by birth-year. The trend lines are estimated as a quadratic function of time, and the shaded areas mark the 95% point-wise confidence interval for these lines (based on a nonparametric bootstrap with 120 trials). The shifts in the reported statistics from the 1952-57 to the 1970-75 birth cohorts are significantly different from zero at the 5% level for the following vigintiles: Panel (a): 1-2,17,19-20; panel (b): 6,8,10,15-16,20. From the 1970-75 to the 1980-85 cohorts, the changes are significant for the following vigintiles: Panel (a): 19; panel (b): 18-19.

Having established that the association between class background and cognitive ability has been relatively stable over the birth cohorts studied in this paper, we now turn to the question of whether the economic consequences of cognitive ability have changed over time. Figure 15 first shows how four of the most important offspring outcomes – earnings rank, employment, disability program participation, and educational attainment – have developed *on average* for each of the three ability groups. A first point to note here is that the high IQ group performs much better along all outcome dimensions than the middle IQ group, which again performs much better than the low IQ group. Turning to the time trends, a somewhat paradoxical pattern emerges; while we see a convergence over time in earnings rank (panel (a)) as well as educational attainment (panel (d)), particularly between the high and low ability groups, there is a sharp divergence in employment and disability program participation (panels (b) and (c)). It is natural to interpret the convergence in earnings rank as a direct result of the convergence in educational attainment. As the limited post-compulsory educational capacity available for the cohorts born in the early 1950's to a large extent was occupied by the high IQ group, the subsequent expansion of the capacity has almost exclusively benefited the groups of low and middle IQ. However, this development may also have enlarged the productivity divide between persons who thrive in the schooling system, and those who do not.

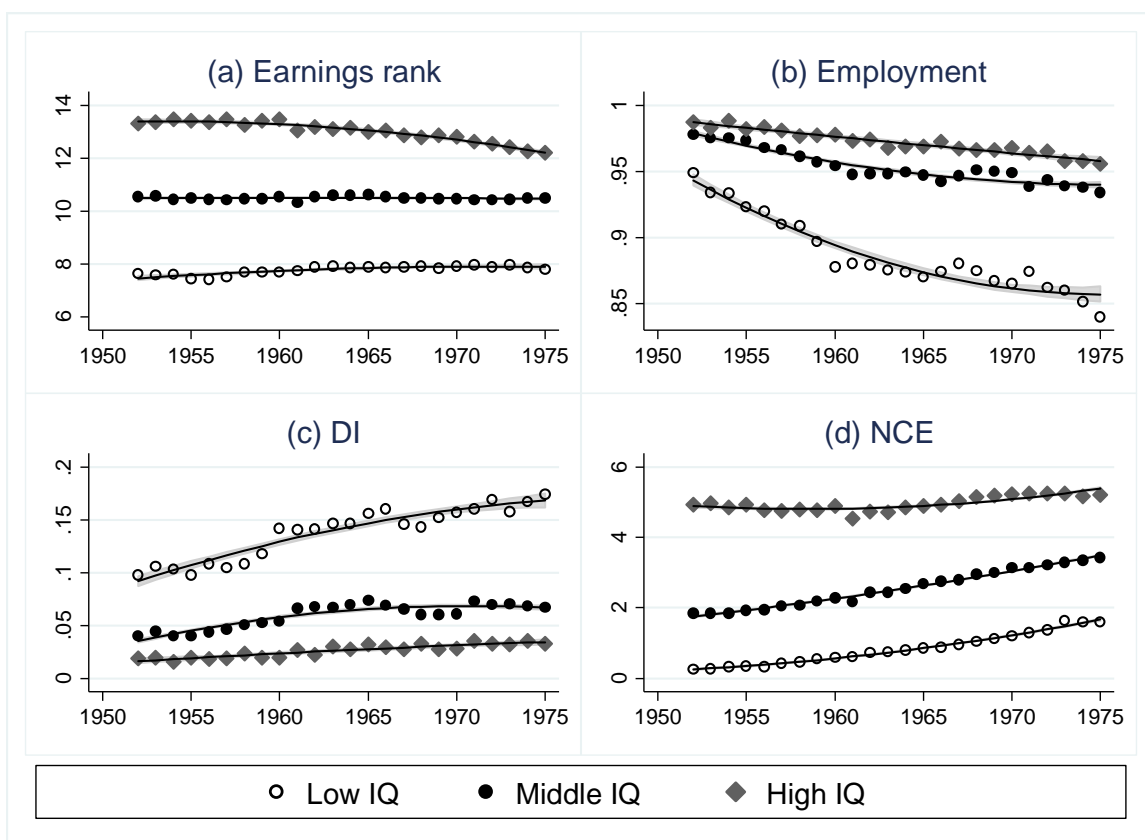


Figure 15. Trends in offspring outcomes. By IQ group.

Note: Panel (a) show earnings rank, panel (b) employment, panel (c) disability insurance program participation (DI), and panel (d) years of non-compulsory education. The trend lines are estimated as a quadratic function of time, and the shaded areas mark the 95 % point-wise confidence interval for these lines (based on a nonparametric bootstrap with 120 trials).

Since there are more offspring with low IQ in the lower than in the higher economic classes, changes in the relative performance of the different IQ groups clearly spill over to changes in the relative performance of the different classes, *ceteris paribus*. However, the evidence of a significant *improvement* in earnings rank outcomes for offspring with low IQ implies that we can safely reject the hypothesis that the decline in rank mobility out of the bottom classes was a reflection of declining economic fortunes for low IQ offspring more generally. If anything, the improvement in the earnings rank of low ability offspring has been a force for increased mobility out of the bottom classes.

To further examine the combined influences of IQ and class background, Figure 16 presents the *changes* in each vigintile's economic outcomes – from the 1952-57 cohorts to the 1970-75 cohorts – by IQ group. To facilitate interpretation, we add in quadratic regression lines (with 95 % confidence intervals) in these graphs. Focusing first on earnings rank and education (the upper six panels), Figure 16 illustrates three important points. The first is that regardless of IQ, the bottom class vigintiles have lost out in terms of earnings rank (panels (a)-(c)). The second is that while the relationship between changes in earnings rank and economic class has been strictly positive for offspring with low IQ, it has displayed a conspicuous non-monotonic pattern in the medium and high IQ groups. And the third is that there has been a striking similarity between the changes in earnings ranks and the changes in education outcomes (panels (d)-(f)). The groups that have increased their education the most have also improved their earnings rank at the expense of those who have increased it least.

To sum up, the earnings rank losers can be divided into three groups: i) Those belonging to the lowest economic classes (regardless of IQ); ii) those with high IQ (regardless of class), and iii) those with medium IQ and high class. For the former group, it is probable that the declining upward mobility has been related to the rising role of family support in a knowledge-based economy where educational attainment increasingly has become a precondition for economic success. For the latter two groups, it is natural to interpret the declining rank outcomes as a result of increased competition from offspring with lower ability who have gained access to educations that for the earliest cohorts were more or less reserved for those with high IQ and/or medium IQ and high class. The earnings rank winners can similarly be divided into two groups: i) Those with low IQ, but not coming from the very lowest economic classes; and ii) those with middle IQ from the middle classes. These groups have in common that they have experienced the largest increase in educational attainment, as the expanded capacity have gradually allowed for inclusion of more students with lower cognitive abilities.

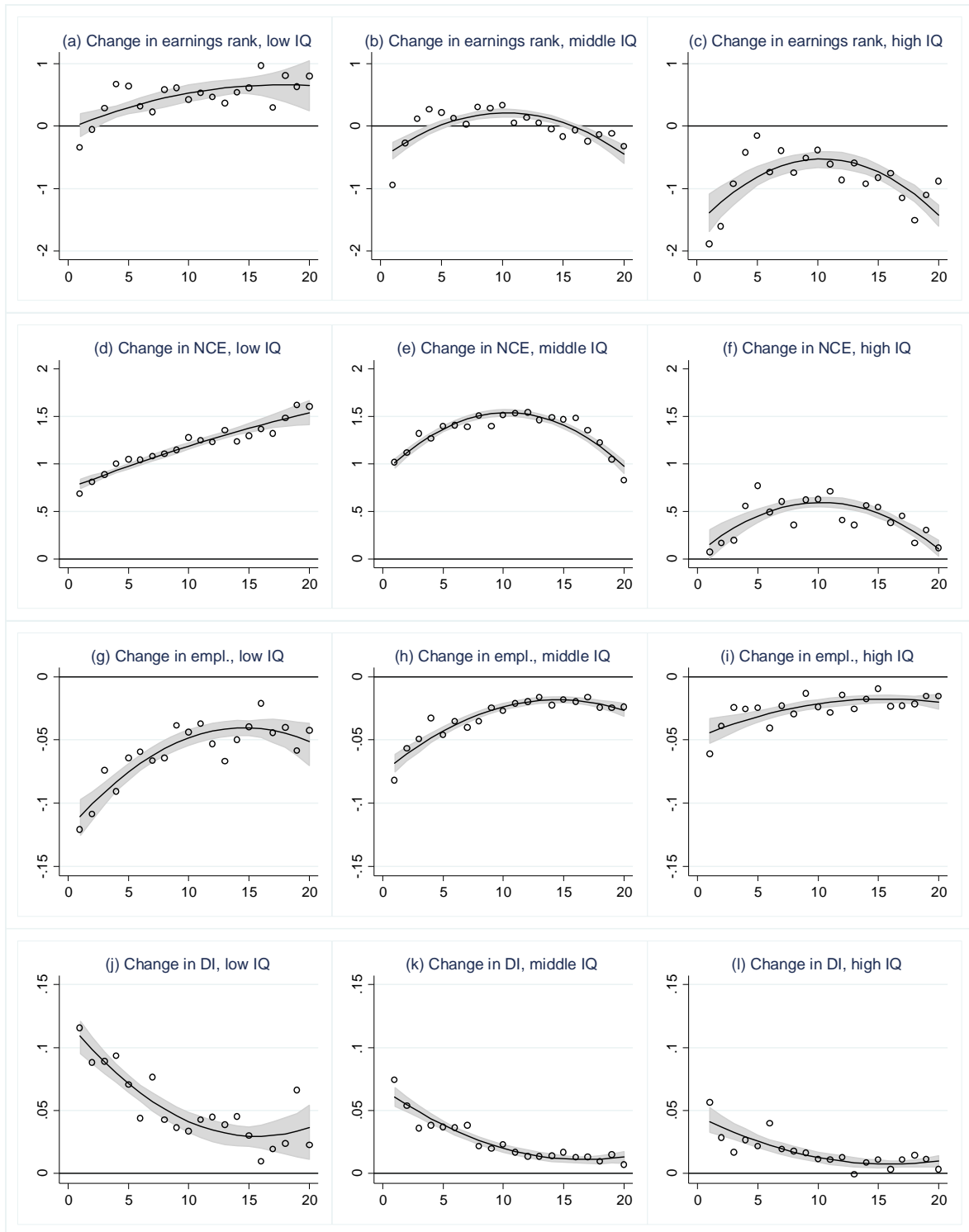


Figure 16. Changes in economic outcomes from the 1952-57 to the 1970-75 birth cohorts. By class vigintile.

Note: The regression lines are estimated as quadratic functions of vigintile number, and the shaded areas mark the 95 % point-wise confidence interval for these lines (based on a nonparametric bootstrap with 120 trials).

Panels (g)-(l) then show how employment and disability outcomes have changed across IQ groups and economic classes. The decline in employment – and rise in disability program participation – is clearly largest the lower is IQ *and* economic class. This has little to do with economic mobility *per se*, but reflects that the lowest ranked earnings outcomes to an increasing extent have become associated with non-employment rather than with low-wage employment. For example, while around 45 % of the sons in the lowest earnings rank vigintile were employed in the early 1950s cohorts, this vigintile consisted *only* of non-employed people 10 years later. And from the 1960 cohort and onwards, the group of non-employed gradually made up an increasing share of the second vigintile as well, reaching approximately 50 % of the 1975-cohort.¹² Since the low IQ group has a much larger share of its population concentrated in the lowest earnings ranks, this development also explains why employment has declined disproportionately in this group, despite the overall rank improvement among low IQ sons.

Finally, to assess the potential role that educational attainment has played in shaping the changes in ranks and employment rates of the three IQ groups, Figure 17 shows the earnings and employment ranks over time for each IQ group, but this time with each IQ group divided into subgroups defined by their highest obtained education at age 28. Panels (a)-(c) first show that, *conditional on educational level*, almost all groups experienced a decline in earnings rank; and the decline was larger the higher was the IQ. The explanation behind this apparent paradox is illustrated in panels (g)-(i), showing that the fractions with secondary and tertiary educations increased in all groups, implying that the probability masses shifted from the lower to the upper curves in panels (a)-(c). And in the low IQ group, this increase was sufficient to ensure a rise in the group members expected earnings rank. However, as shown in panels (d)-(f), the (declining) subgroups consisting of individuals with primary (compulsory) education only, experienced a spectacular drop in prime age employment rates; from 13 percentage points in the high IQ group to as much as 20 percentage points in the low IQ group. Although the relationship between schooling and employment obviously cannot be given a causal interpretation, these changes illustrate the critical role that educational attainment appears to play for the later cohorts.

¹² Recall that our non-employment definition requires that average annual earnings from age 28 through 40 is below 1/3 of average full-time-full-year earnings in Norway. Hence, the non-employed will typically have been outside the labor market (or have had a very weak attachment) in most – but not necessarily all – of these years.

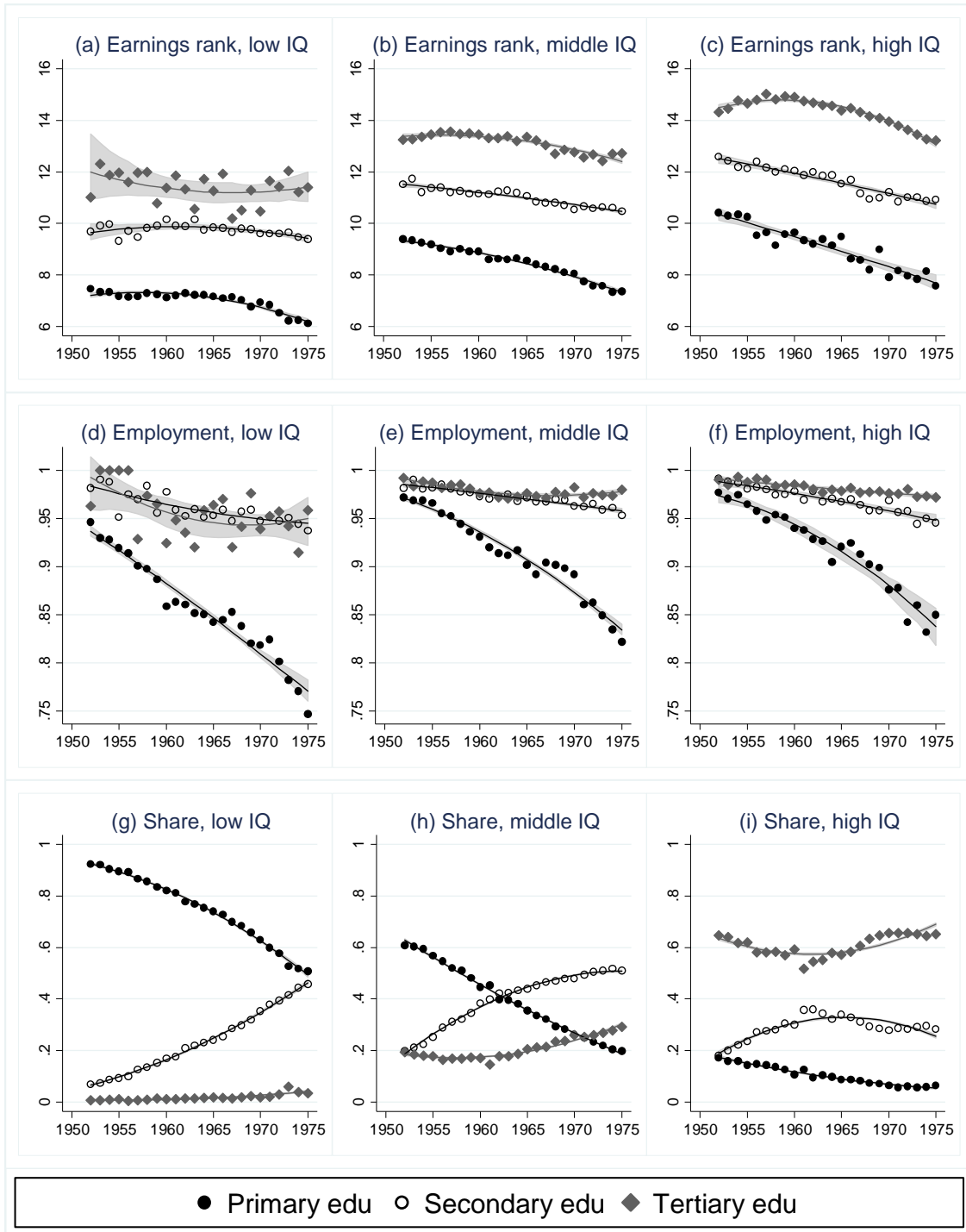


Figure 17. Trends in offspring outcomes for offspring with primary, secondary, or tertiary education. By IQ group.

Note: Panels (a)-(c) show earnings rank and panels (d)-(f) employment, in all cases separately for offspring with primary, secondary, or tertiary education recorded as the highest education at age 28. Panels (g)-(i) show the fractions in each IQ group with such education. The trend lines are estimated as a quadratic function of time, and the shaded areas mark the 95 % point-wise confidence interval for these lines (based on a nonparametric bootstrap with 120 trials).

5.2 The role of neighborhoods

To what extent are offspring's opportunities for economic mobility shaped by the neighborhoods in which they grow up? Recent evidence from the U.S. indicates that the quality of the childhood neighborhood is of huge importance for economic mobility there (Chetty and Hendren, 2015; Chetty et al., 2016). Given the much smaller class difference between neighborhoods in Norway, and given the deliberate redistribution of public resources (e.g., for education purposes) toward the poorest areas (see Section 2), it is not obvious that they play the same role in our data. To examine this question, we use register-based information about parents' residential neighborhood. The "neighborhoods" we use for this purpose are the basic statistical tracts, defined by Statistics Norway. These units are small (350 inhabitants on average) and homogenous with respect to housing standard; see Statistics Norway (1999) for details. In order to assign an economic rank to each of the approximately 13,700 neighborhoods in each year, we have used the following strategy: First we identify all residents aged 36-61 in all neighborhoods and for all years 1992-2015. Then, for each age (36, 37,...,61) and for each gender, we compute the age- and gender-specific earnings rank, so that each person is assigned a rank from 1 to 20 for each year. Finally, we compute for each neighborhood and for each year the average rank among its inhabitants, and then sort the neighborhoods into (population-weighted) vigintiles based on the average rank.

Ideally, we would have liked to identify the neighborhood where the parents lived at time of their offspring's childhood. However, information about residential address is available only from 1992. Hence, what we can do in a consistent fashion is to identify the address of (still alive) parents when the offspring are 40 years old.¹³ This is of course an imperfect proxy for the place they lived when the offspring were young, but it is the best we can do with our data without treating different cohorts differently. For the cohorts reaching 40 toward the end of our observation period (in 2014 and 2015), we can check the quality of our neighborhood proxy by comparing it with their parents' actual neighborhood when the offspring were 18. It then turns out that 54 % of the parents lived in exactly the same neighborhood as they did 22 years later. More importantly, the correlation between the average economic rank of the neighborhood inhabited at offspring-age 40 and that inhabited by offspring-age 18 is as high as 0.69. Hence, we consider the rank of the age 40 parental neighborhood to be a relatively good proxy for the rank of the childhood neighborhood.

Equipped with the resultant neighborhood rank characterization, we first examine trends in the association between parental economic class and the class rank of the childhood neighborhood. The results

¹³ If both parents have died when the offspring reaches age 40, we are unable to identify the childhood neighborhood. As a result we lose approximately 5-7 % of the observations in this exercise.

are displayed in Figure 18. Comparing parents of the first and last six birth cohorts, panel (a) shows that there has been a development toward *less residential segregation*, in the sense that lower class parents live in higher ranked neighborhoods than before and higher class parents live in lower ranked neighborhoods. The only exception from this pattern is found at the very bottom of the class distribution. Panels (b) and (c) show that these developments are parts of broader trends. The correlation between parental and neighborhood class has dropped from approximately 0.32 to 0.24. Yet, the very lowest class vigintile have experienced a slight deterioration in neighborhood class. It is also notable that in both time periods, there is much more segregation at the top of the class distribution than at the bottom. While parents in the top vigintile on average reside in neighborhoods just 4-5 classes below themselves, parents in the bottom vigintile reside in neighborhoods 8 classes above themselves.

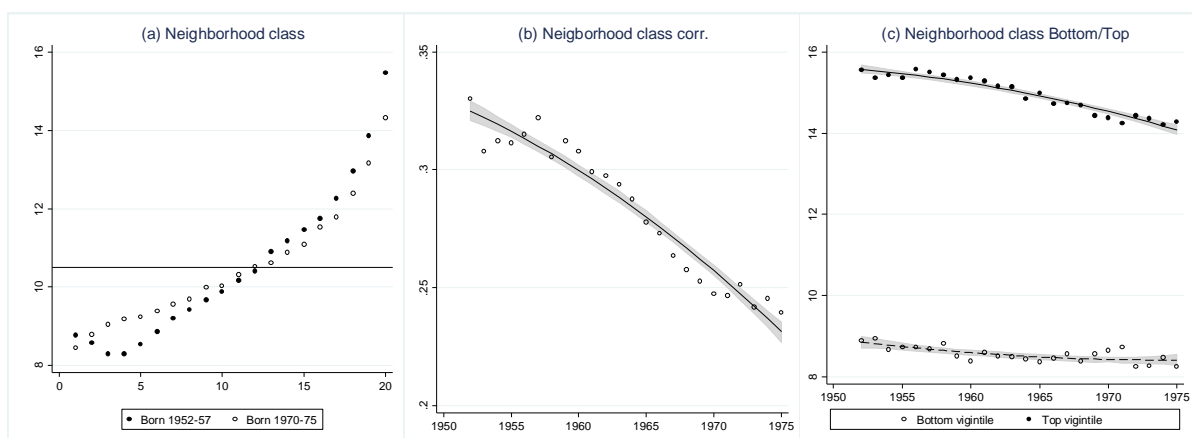


Figure 18. *The association between family class background and neighborhood class background.*

Note: Panel (a) shows the average rank of parental neighborhood by parental class rank. Panel (b) shows the correlation between the rank of parents and their neighborhoods by birth cohort. Panel (c) shows the average rank of parental neighborhood for the top and bottom parental classes by birth cohort. The trend lines in panels (b) and (c) are estimated as a quadratic function of time, and the shaded areas mark the 95 % point-wise confidence interval for these lines (based on a nonparametric bootstrap). The shifts in the reported statistics from the 1952-57 to the 1970-75 birth cohorts in panel (a) are significantly different from zero at the 5 % level for all vigintiles except vigintile 12.

To shed some light on the potential impacts of neighborhood rank, Figure 19 shows how various offspring outcomes have developed over time by class and neighborhood background. Here, we focus on the lower and upper deciles of the class background distribution only, and classify the childhood neighborhood as “poor” if it belonged to the 25 % neighborhoods with lowest earnings, and “rich” if it belonged to the 25 % neighborhoods with highest earnings. The results are illustrated in Figure 19. Focusing on the earnings rank outcomes in panels (a) and (b), we first note that conditional on own class background, offspring in rich neighborhoods do considerably better than those in poor neighborhoods. The difference is larger for offspring from the lowest classes than for offspring from the highest classes. For the first birth cohorts, i.e., those born in the 1950s, the neighborhood influence was apparently much larger for sons than for daughters (in line with results reported by Chetty and Hendren (2015)),

but this gender difference has gradually evaporated. Moving on to the employment outcomes in panels (c) and (d) and the disability program participation outcomes in panels (e) and (f), we again see signs of a much larger – and also more increasing – role for neighborhood-influences in the lower classes. The apparently rising neighborhood influence on disability program participation is in line with findings reported on neighborhood peer effects in Markussen and Røed (2015).

Taken together, we conclude from these exercises that, the decline in residential segregation in the parent generations have been a force for increased economic mobility, with a notable exception for the lowest class vigintile. However, the rising neighborhood differentials in employment and disability program participation may have contributed to the increased class gradient in these outcomes.

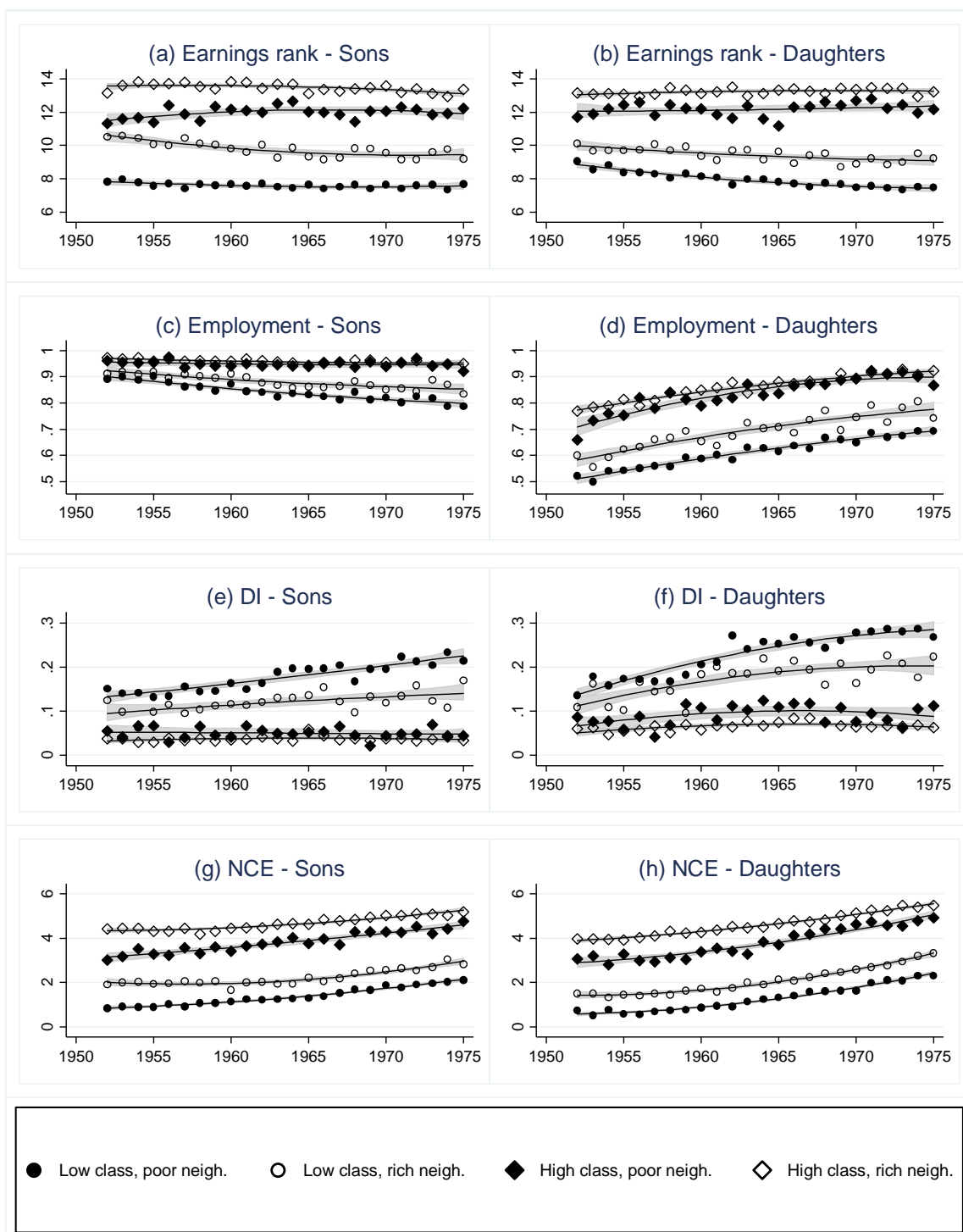


Figure 19. Trends in offspring outcomes for offspring with different combinations of class and neighborhood background.

Note: Panels (a)-(b) show earnings rank, panels (c)-(d) employment, panels (e)-(f) disability program participation (DI), panels (g)-(h) the number of years of non-compulsory education (NCE), in all cases separately for four different combinations of parental and neighborhood class. "Low class" encompasses the lowest decile in the class background distribution, and "high class" encompasses the highest decile. "Poor neighborhood" encompasses the 25% neighborhoods with lowest average earnings rank and "rich neighborhood" encompasses the 25% with highest average earnings rank. The neighborhoods' earnings ranks are computed on the basis of their complete working age populations, as described in the text. The trend lines are estimated as a quadratic function of time, and the shaded areas mark the 95% point-wise confidence interval for these lines (based on a nonparametric bootstrap with 120 trials).

6 Concluding remarks

In this paper, we have documented trends in intergenerational economic mobility among Norwegian offspring born between 1952 and 1975 (1985 for educational outcomes). For sons, we have found that rank-rank earnings mobility has remained relatively stable, with a slight decline over the 1952-1965 cohorts, and a corresponding improvement afterwards. The most conspicuous development, however, is that sons born into the lower decile of the parental earnings rank distribution have fallen considerably behind along all quality-of-life outcome dimensions studied in this paper; i.e., not only earnings, but also employment, educational attainment, health (as measured by disability program participation), family formation, and mortality. For daughters, we have found that mobility has declined throughout the parental rank distribution, as part of a convergence toward the mobility patterns of men. And also for daughters, economic mobility has declined most at the bottom of the class distribution.

The decline in upward mobility for those born into the poorest families may at first sight appear surprising, given that the time period covered by our data also was one of considerable expansion of the welfare state, including policies specifically aimed at leveling the economic playing field. In particular, it was a period of massive public investments in free childcare and education at all levels. Based on test scores for cognitive ability for young men, we can more or less rule out that the relative decline in economic outcomes for offspring from low class families resulted from a relative decline in their cognitive abilities. The lower classes did not fall systematically behind in terms of cognitive ability.

Since offspring with low cognitive ability have been overrepresented in the low class families throughout our data period, it could still be hypothesized that the trends responsible for reducing upward mobility from low class families were not primarily related to economic class *per se*, but rather reflected deteriorating economic prospects for people with low ability within all classes. However, the empirical evidence presented in this paper does not support such a conclusion. Low-ability persons have *not* been left behind more generally. To the contrary, we show that low-ability offspring on average have improved their earnings rank, relative to those with higher cognitive ability, probably as a result of the expansion of educational opportunities. Hence, the declining mobility out of the lowest economic classes appears to have arisen from a change in the causal relationship between family background and economic outcomes, and not just from a compositional change in earnings-related abilities within each class. Belonging to the very lowest class background vigintiles has been associated with deteriorating quality-of-life outcomes regardless of cognitive ability.

While the analysis in this paper has not been designed to identify and quantify specific causal mechanisms, our findings are consistent with a story of skill-biased changes in labor demand in combination

with expansion of educational opportunities allowing for a corresponding skill-upgrading of the labor force. Together, these trends have created a more knowledge-based economy, where educational achievement has become a more critical feature of labor market success. As a result of the large increase in public investments in education, the access to the education system has no doubt become more equally distributed, both in terms of class and in terms of cognitive ability. However, the rising importance of educational achievements has also made educational support and encouragement provided by the family more crucial. And existing empirical evidence has shown that such support is provided much more by higher than by lower class parents (see Section 2). As a result, the lower class offspring may have fallen behind in the race toward higher education. At the same time, the individual economic consequences of *not* achieving a minimum level of education have become much more severe, and a rapidly increasing share of those who have failed to obtain an upper secondary education has dropped out of the labor market.

The declining economic mobility out of the lower economic classes suggests that the Norwegian welfare state model has not been fully successful in achieving a more mobile society where economic outcomes of offspring have become less associated with those of their parents. In particular, it has failed its aim of securing employment and earnings opportunities that are unrelated to class background. To the contrary, we have seen a precipitous drop in prime age employment rates for men born into the lower economic classes, particularly for those with low cognitive ability.

Although we have focused on economic success in terms of gross labor market earnings and employment in this paper, it may be argued that the basic idea of the welfare state is not primarily to ensure equality of labor market opportunities, but rather to protect the living standard of those whose labor market opportunities have not been satisfactorily secured. We have shown in this paper that the declining employment rates at the bottom the class background distribution have been paralleled by rising rates of disability program participation, which in Norway entails a benefit level corresponding to around two thirds of the (presumed) forgone earnings. In addition, progressive taxation has ensured considerable redistribution of the “fruits of labor market success”. As a result, the welfare state may have achieved a certain degree of mobility in *living standards*, or in consumption opportunities as measured by total net (after tax) income. We end this paper by comparing the shares that each class background vigintile have received out of the cohort’s total pre-tax labor earnings (repeated from Figure 4, panels (c) and (d)) with their shares received out of total post-tax and post-transfer incomes. As we do not possess data on post-tax-post-transfer incomes during age 28-40 for cohorts born before 1970, we can only do this for the last six cohorts (1970-75) in our data. The results are presented in Figure 20. They show that family background has much less impact on an offspring’s post-tax income

share than it has on pre-tax earnings. This is particularly the case for daughters, reflecting that transfers constitute a relatively more important source of income for women than for men.

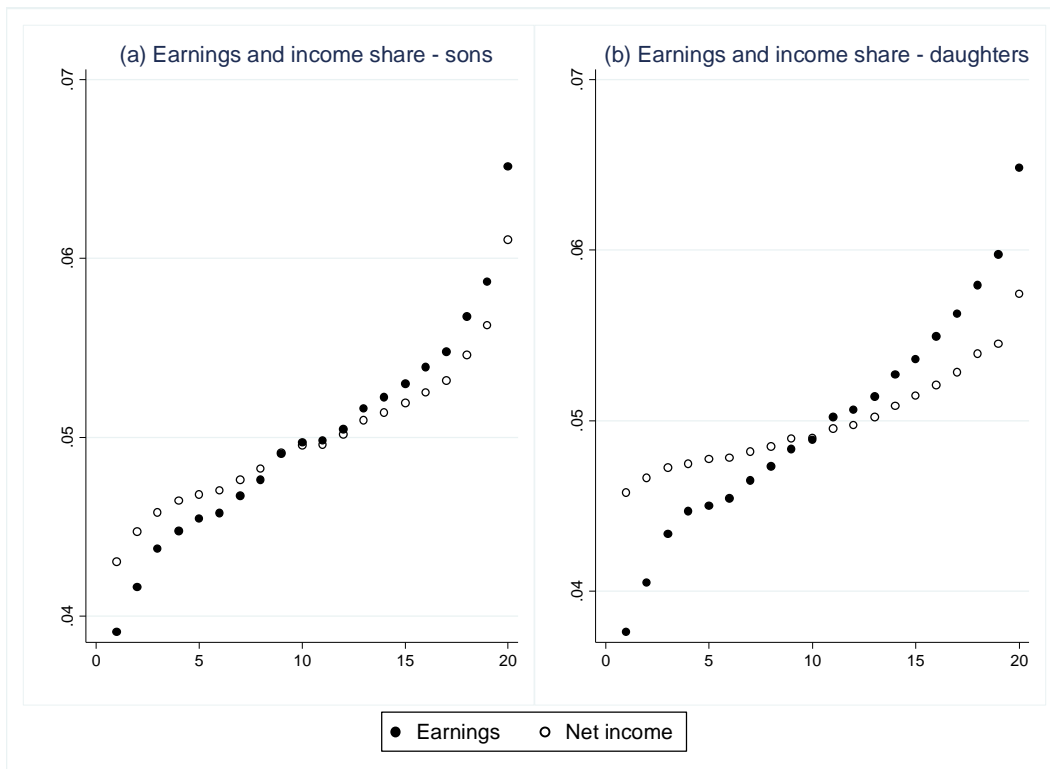


Figure 20. Earnings and net income shares (age 28-40) by class background. 1970-75 cohorts.

Note: Net income is calculated after tax and includes all labor-related earnings and transfers, but excludes capital income. Earnings are measured pre-tax, and include labor-related earnings only.

After the welfare state has redistributed earnings through taxes and transfers, the influence of family background on offspring income is remarkably small. Comparing offspring born into the five percent richest and the five percent poorest families, the difference in own prime age net income is not larger than 40 % for men and 25 % for women. Hence, while egalitarianism may be on the defensive with respect to guaranteeing equal labor market opportunities for all, regardless of class background, it still appears to secure a considerable degree of equality in consumption opportunities.

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