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Upper secondary school tracking, labor market outcomes, and intergenerational inequality in Denmark

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Abstract

We study the relationship among family background, placements in upper secondary school tracks, and labor market outcomes in the comprehensive welfare state of Denmark. We base our study on high-quality data from Danish administrative registers with a focus on the 1986 birth cohort, which allows us to examine very fine-grained measures of track placement in upper secondary schools. Our analyses show three results. First, upper secondary track placement is consequential for labor market outcomes, even after we control for the selection into tracks on pre-track academic performance and family background characteristics. Second, upper secondary track placement appears to affect labor market outcomes even net of higher education attainment. Third, educational tracking appears to play a role in intergenerational social reproduction net of family background-based skill gaps, suggesting that track choice help maintain inequalities across generations. We discuss the implications of our findings for the literature on educational tracking.

Keywords:

Upper secondary school tracking; Labor market outcomes; Social Stratification; Educational Inequality

Introduction

A large part of the existing literature in educational research shows that the division of students into different tracks in secondary schools is consequential for educational achievement and subsequent tertiary education choices (Becker et al, 2012; Brunello and Checchi, 2007; Hanushek and Woessmann, 2006; Holm et al, 2013). Moreover, research demonstrates that family background plays an important role in students' track choices. Across various educational systems, students from privileged social backgrounds choose tracks that are associated with higher prestige, higher transition rates to tertiary education, and favorable labor market outcomes (Lucas and Byrne, 2017; Triventi et al, 2019).

While numerous studies document the short-term consequences of track placement for educational achievement and attainment (Gamoran, 2010), less attention has been paid to the extent to which these track choices lead to advantages in the labor market. Because studies typically examine single labor market outcomes (such as occupational status or income), they fail to consider the full range of labor market returns that track placement might yield. Indeed, the payoffs to track placement may vary widely across different labor market outcomes and may depend on the particular institutional configuration of the national context. Furthermore, the existing literature on tracking often relies on relatively crude track placement indicators, meaning that it potentially neglects substantively meaningful variation in track locations in terms of both family background inequalities and long-term payoffs (Blossfeld et al, 2016; Lucas, 1999). In fact, the few studies that examine labor market returns to tracking mostly focus on the broad divide between general and vocational secondary education (Golsteyn and Stenberg, 2017; Hanushek et al, 2017) or early track choice (Dustmann et al, 2017), but do not examine other forms of tracking within the same level of schooling.

In this paper, we examine the extent to which upper secondary track placement affects a range of labor market outcomes in a comprehensive welfare state whose educational system can be categorized as being part of the "Nordic inclusive model" (Triventi et al, 2019). While primary and lower secondary schools are comprehensive and untracked in Denmark, upper secondary education (in Danish *ungdomsuddannelser*) can be divided into two major streams: academic and vocational. In such a "late" tracking regime, students have stayed together comparatively longer in the same schooling environment, which potentially impedes inequalities in educational achievement (Brunello and Checchi, 2007; Hanushek and Woessmann, 2006; Lange and von Werder, 2017). Apart from being part of the Nordic inclusive model, Denmark's high degree of redistribution and -collective wage-setting also means that the economic returns to schooling are comparatively low (Erikson and Goldthorpe, 1992; Landersø and Heckman, 2017). Given these institutional features, we might expect that the labor market consequences of track placement will be less pronounced in Denmark compared to countries with early tracking regimes and more income inequality. Denmark, therefore, provides the opportunity of a very conservative test of the consequences of tracking for labor market outcomes.

We base our study on high-quality data from the Danish administrative registers, which cover the entire Danish population and which comprise rich information on educational pathways, labor market outcomes, academic performance, and family background. We exploit these data to make three contributions to the existing literature. First, we estimate the net labor market returns to upper secondary track placement after adjusting for family background and pre-track academic performance. Second, because academic upper secondary tracks prepare students for higher education, we examine whether choice of higher education (field and level) can explain the net returns to upper secondary track placement. Third, we investigate whether upper secondary track placement independently mediates the association between family

background and labor market outcomes even after we adjust for academic performance. We conclude the paper with a discussion of the implications of our results for the role of educational tracking in generating inequalities across the life course.

Upper secondary school tracking in Denmark

Denmark is a prototypical Scandinavian welfare state with generous redistribution and comparatively high welfare and education expenditures. According to comparative research, Denmark also has among the highest levels of intergenerational education and income mobility in the world (Björklund et al, 2002; Harding and Munk, 2020; Pfeffer, 2008). OECD estimates indicate that the share of Denmark's gross domestic product spent on education was 6.4 percent in 2013, which qualifies as one of the highest shares among all OECD countries (OECD, 2016:198). Before entering primary school, most children in Denmark aged 1–6 attend highly subsidized high-quality daycare, which likely leads to more equality in terms of academic outcomes and higher levels of intergenerational social mobility (Esping-Andersen, 2004; Esping-Andersen et al, 2012).[1]

Persons born in 1986 in Denmark—the focal birth cohort in our empirical analyses—moved through the Danish educational system the following way: from grades one through nine, they attended a completely untracked and comprehensive school (*Grundskole*) covering the primary and lower secondary school level.[2] While most students attend a public comprehensive school, a minor share of students (14 percent in 2008) attend private schools, which are heavily subsidized by the state. Upon completing lower secondary school, students can either (a) leave the educational system (for unskilled work or unemployment benefits); (b) attend a vocational upper secondary school (vocational training) for a three-to four-year program, which is a mixture of formal schooling and apprenticeship-based training and which prepares students for skilled

work; or (c) attend an academic upper secondary school (the *Gymnasium*) for a two- or three-year program that prepares students for higher education (Holm et al, 2013). Among those with a vocational upper secondary degree, very few later on upgrade to an academic upper secondary (gymnasium) degree (only 8 percent for individuals born between 1985 and 1988, see Wahler, Bucholz and Møllegaard, 2016: 206), which underlines the critical relevance of this first decision point for future educational trajectories. While there are more than one hundred different vocational training programs to choose between, ranging from carpentry to web design, here we focus on the institutional differentiation of *academic* upper secondary education. In addition to the traditional general gymnasium (labeled STX), alternative and more occupation-oriented gymnasium types were established in the course of the 1960s and 1970s (see Holm et al. 2013). For our focal birth cohort, these four gymnasium tracks can be distinguished:

- STX (*Almen studentereksamen*): The traditional academic gymnasium, a three-year program.
- HHX (*Merkantil studentereksamen*): The mercantile gymnasium, a three-year program.
- HTX (*Teknisk studentereksamen*): The technical gymnasium, a three-year program.
- HF (*HF eksamen*): A two-year "late starter" gymnasium.

Whereas those attending STX and HF often share the same school campus, those attending HHX (the mercantile gymnasium) attend their own school, as do those attending HTX (the technical gymnasium). Thus, academic upper secondary schooling in Denmark is characterized by between-school tracking. However, the STX (academic gymnasium) is further differentiated into different areas of specialization combining overarching tracks and electives. As a result, the STX track can be characterized by substantial within-school tracking. As Table 1 shows, among all individuals born in 1986, most students attend STX (31 percent; 18 percent with mathematics

specialization and 13 percent with language specialization), followed by the HHX (12 percent), HF (9 percent), and HTX (4 percent), meaning that in total 56 percent complete an academic upper secondary track. Completion of all academic upper secondary tracks (STX, HHX, HTX, and HF) leads to eligibility for higher education.[3] Three levels of higher education can be differentiated: short-cycle (*erhvervsakademiuddannelse*, for example dental hygiene, 2–3 years), medium-cycle (professional bachelor, for example nursing, 3–4 years), and long-cycle (university, for example medical sciences, 5–6 years). Within each level, there are multiple degree programs across different fields of study.

Supplementary material A (see Birkelund, Karlson and Reimer 2020) provides an overview of flows from each gymnasium track into higher education level and field of study, documenting a high degree of heterogeneity of flows and path dependencies. Still, choice of higher education level and field is associated with specific academic upper secondary tracks. Students with a HF degree, for example, mainly choose short- and medium-cycle higher education. HTX students (the technical gymnasium) very often choose degrees in engineering, and HHX students (the mercantile gymnasium) mainly choose higher education degrees in trade and business.

Upper secondary tracking and labor market outcomes

While research on educational tracking in Denmark clearly shows that family background and academic performance are strong determinants of track placement after the completion of comprehensive schooling (Holm et al, 2013; Holm, Hjorth-Trolle, and Jæger, 2019; Holm and Jæger, 2013; Jæger and Holm, 2007; Karlson, 2011; Wahler, Buchholz, and Møllegaard, 2016), no study to date has examined the labor market consequences of different completed upper secondary tracks. Track placement may be consequential for labor market outcomes as a result of at least four intertwined mechanisms: (*1*) *Selectivity*, implies that the selection into tracks on

various factors such as skills, aspirations, and family background characteristics accounts for the tracking effects. (2) *Differential pathways*, imply that differential track choices in upper secondary education lead to institutional path dependencies in terms of further educational choices—both in terms of subsequent higher educational level and field of study. (3) *Differential learning opportunities*, imply that tracking affects skills development differentially, something that ultimately affects labor market success given the returns to skills on the labor market. Such differential learning opportunities can be the result of differential instruction (captured by variation in curriculum and teacher quality) and/or differential peer composition, which implies spillover effects within programs (Gamoran, 2010). (*4*) *Differential signaling*, meaning that both students and potential employers attach different signaling values to different tracks (see Bills, 2003). Some tracks can carry a negative *social stigma* (Oakes, 2005; Solga, 2002), which students may eventually incorporate into their self-concept and act upon accordingly (Mijs 2016). Other tracks, particularly those involving much math and science content, might function as a positive signal to potential employers about students' skills and productivity (Rose and Betts, 2004).

[FIGURE 1 ABOUT HERE]

While the first mechanism (selectivity) implies that track effects are spurious, the second mechanism (differential pathways) emphasizes tertiary education attainment as a mediator of the effect of upper secondary track placement on labor market outcomes. The third (differential learning) and fourth (differential signaling) mechanisms imply that track placement has independent (causal) effects on labor market outcomes. Figure 1 provides a summary of the four mechanisms. Although we cannot fully disentangle all of these mechanisms in this paper, we attempt to resolve whether track placements have independent effects net of selectivity in

Denmark, irrespective of which of the three other mechanisms are driving the results. Thus our first research question is: *What are the net labor market returns to upper secondary track placements*? (RQ1). We address this question by examining whether track placement effects still exist after we adjust for pre-track academic performance (capturing both skills and effort) and very detailed family background characteristics.

The second mechanism through which upper secondary track placement can affect labor market outcomes is differential pathways. In Denmark, only academic upper secondary education (Gymnasium), as opposed to vocational upper secondary education, by default prepares students for higher education. Holm et al. (2013) have examined the impact of different academic upper secondary track types on higher education, and found that attending certain academic tracks (mainly STX and HTX) increases the likelihood of enrolling in higher education at different levels. Because higher education is known to have significant returns on the labor market (Hout, 2012), as do different fields of study (Gerber and Cheung, 2008; Reimer and Thomsen, 2019), we expect that choice of higher education mediates a substantial portion of the net effects of upper secondary track placement on labor market outcomes. Thus our second research question is: *Does the completion of level and field of higher education mediate the net labor market returns to upper secondary tracking*? (RQ2). We examine this question by controlling for very detailed indicators of level and type of higher education.

As previously discussed, educational track placement is strongly tied to family background. Given the potential returns to different tracks on the labor market, we should expect that upper secondary tracking is a mediator of intergenerational reproduction of the association between family background and labor market outcomes. While there is ample evidence to support that education is a powerful mediator of this association (Breen and Jonsson, 2005),

previous research has not attempted to isolate whether upper secondary school tracking mediates this relationship independently of the selection into tracks on academic performance. Thus our third research question is: *To what extent does upper secondary track placement independently mediate the association between family background and labor market outcomes even after we adjust for academic performance*? (RQ3). We examine this research question empirically by gauging the extent to which our track placement indicators mediate the association between students' social origins and their labor market destinations net of academic performance.

Data and methods

We analyze the effect of upper secondary track placement on early labor market outcomes using data from the Danish administrative registers. Our analyses rely on the cohort of all Danes born in 1986, because this is the first birth cohort with recorded information on lower secondary school GPA (our measure of pre-track academic performance), and because it can be followed in the occupational registers until age 30, allowing us to examine these individuals entry into the labor market. We restrict the sample to those who are alive and living in Denmark at age 30 and who were living in Denmark at age 6, the age at which primary school starts (N = 53,448). We exclude individuals with missing information on the independent variables used in the analyses (about 10 percent).[4] Because we can only observe individuals through age 30, we also exclude individuals who still are in education at age 30 (about 7%). The final analytical sample consists of 43,972 individuals.

We examine three labor market outcomes, each of which captures different aspects of labor market success. First, we examine class attainment, using the Erikson–Goldthorpe–Portocarero class scheme (EGP, see Erikson, Goldthorpe and Portocarero 1979) and focus on the attainment of the highest-ranked class positons ("service class I+II"). Class position is a general indicator

for social relations in economic life, and is directly related to individuals' general economic conditions and prospects (Goldthorpe and McKnight, 2006). In this analysis, we treat individuals who are unemployed or have missing occupational information as missing observations. Second, we are interested in the opposite side of labor market success, and therefore examine the association between track placement and unemployment status. This is relevant in in light of research showing that vocational secondary education can function as an effective safety net against unemployment, but potentially hinders further career advancement (Shavit and Müller 2000). We measure unemployment using information on the main source of income in 2016, when individuals from the 1986 cohort were 30 years old. Individuals with a main source of income from cash benefits or unemployment benefits were coded as unemployed. Moreover, we treat individuals with missing occupational information or who are on any type of leave or receiving disability pension as missing observations. Finally, we examine a widely used indicator for economic labor market success, individual earnings (measured in log earnings). We measure earnings in pre-tax earnings (excluding income from self-employment) in Euros, deflated to 2016 prices.

Our main independent variable is upper secondary educational attainment measured at age 30. We use both a crude and a detailed indicator. The crude indicator has three categories and distinguishes among none, vocational education, and academic upper secondary education, which are the major routes from which children completing lower secondary school can choose. The detailed indicator further distinguishes among the four different tracks in the Gymnasium. However, for the quantitatively largest gymnasium track (STX) we further differentiate between students who chose a mathematics vs. a language specialization, leading to five overall categories: mathematics (STX), language (STX), short-term (HF), mercantile (HHX), and technical (HTX).[5]

To answer RQ2, we include measures of tertiary education attainment as mediating variables. We consider 1) a crude indicator that distinguishes between level of tertiary education only (none, short-cycle, medium-cycle, and university education), 2) a detailed indicator that differentiates field of study, distinguishing between nine fields of study within each tertiary education level (humanities, social sciences, law, business, natural sciences, engineering, health, teaching/education/social work, and other fields) resulting in 18 tertiary education categories, as some level and field combinations do not exist, and 3) an extremely detailed indicator that distinguishes between all 817 tertiary education degrees in the Danish education system.

To control for the selection into upper secondary tracks for the 1986 birth cohort, we include the variables listed in Table 1. Most importantly, we control for lower secondary school GPA, which is the average grade across all subjects and which consists both of teacher-awarded grades at the end of compulsory schooling and of grades from the final national exams graded by teachers and external examiners. The latter fact leads to good comparability of this indicator across schools. Furthermore, based on results for a younger cohort, the ninth grade exam scores correlate highly with academic aptitude tests based on item-response theory measurements (Rohde Skov and Hønge Flarup, 2020). In addition, we control for gender, ethnicity, family type, number of siblings, highest level of parental education, highest level of parental social class, and total parental income rank, all measured when the individual is 15 years old.

[TABLE 1 ABOUT HERE]

As Table 1 shows, for the 1986 cohort, the majority of individuals, 85 percent, complete an upper secondary education. Among those completing an upper secondary education, roughly one-third complete a vocational education and the remaining two-thirds complete an academic upper secondary education. Among those attending the academic stream, around one-third

complete the STX mathematics track, around one-quarter the STX language track, around 15 percent the short-term late-starter track (HF), around one-fifth the mercantile track (HHX), and slightly fewer than one-tenth complete the technical track (HTX). In terms of this cohort's family background, roughly 40 percent have parents with a service class (I+II) job, a small minority are of immigrant origin, most come from two-parent families, and the average number of siblings is about 1.5. As for the outcome variables at age 30, 46 percent occupy a service class position, eight percent are unemployed, and average annual earnings are roughly 44,000 Euros (2016 prices).

Analytical strategy

We investigate the relationship between tracking and labor market outcomes in three steps that follow the three research questions described earlier. First, to answer RQ1, we estimate linear regression models in which we regress each of the three labor market outcomes (at labor market entry) on our upper secondary track placement indicators. We estimate OLS regression models for both the continuous (log income) and the two binary dependent variables (service class attainment and unemployment), and report unstandardized coefficients. For the two binary outcome variables, this implies that we estimate linear probability models (LPM), which are increasingly considered a viable alternative to logit or probit models (Breen, Karlson and Holm 2018; Battey, Cox and Jackson 2019). Compared to nonlinear models, these have the advantage that the coefficients can be interpreted more intuitively as the change (in percentage points) in the probability of $y = 1$ for a unit increase of the independent variable(s). We report estimates controlling and not controlling for lower secondary school GPA (Table 2, Models 1–2). Second, to answer RQ2, we examine how choice of higher education mediates the tracking effects, and we investigate whether the level of differentiation by which we measure higher education

matters for the degree of mediation (Table 2, Models 3–5). Third, to answer RQ3, we examine whether upper secondary track placements mediate the association between parental education and children's labor market outcomes after we adjust for pre-track academic performance (Table 3).

Results

Labor market returns to upper secondary track placement

Table 2 shows estimates from linear regression models regressing labor market outcomes at age 30 on upper secondary school track placement. The reference category for our track placement variable is leaving the educational system after lower secondary school. Panel A shows estimates not controlling for the selection into tracks on lower secondary school GPA (our measure of pre-track performance) and for family background variables. Panel B reports the corresponding estimates controlling for these variables. Across models in each panel, we control for different sets of variables. While Model 1 includes the crude three-category indicator for upper secondary education, Model 2 includes the more detailed track indicator that further differentiates between the different academic upper secondary tracks.[6]

[TABLE 2 ABOUT HERE]

Comparing Models 1 between Panels A and B, we find that pre-track academic performance explains a substantial portion of upper secondary track gaps in the three outcomes measured at labor market entry, although the relative reduction varies across the outcomes. For the first labor market outcome, having a service class position at age 30, the coefficient for the academic track compared to the reference category is reduced from 49 to 28 percentage points across specifications, which constitutes a substantial reduction. Similarly, the earnings returns

decline from about 36 to 23 percent after we control for pre-track academic performance and family background characteristics, while the reduction for unemployment is more moderate. A comparison of the coefficient estimates for completed vocational upper secondary with the reference category yields some notable results: we find no effect of vocational education on access to the service class. Instead, vocational education appears to protect against unemployment. Moreover, the earnings returns to a vocational degree are similar to those observed for the academic track in the model that accounts for differences in academic performance (23 percent, Model 1 Panel B), reflecting that we measure earnings early in the career (particularly for those who complete an academic track, as they generally enter the labor market at a later age). Furthermore, comparing Models 1 across Panels A and B, we see that controlling for pre-track performance and family background only changes the vocational track estimates to a minor degree and not to the same extent as for the academic track. This result indicates that skills-based selection into the academic track is more pronounced than skills-based selection into the vocational track. Furthermore, vocational and academic upper secondary education offer advantages (compared to no further education) in terms of reduced unemployment risks and higher earnings. For the attainment of an upper service class position, however, only academic upper secondary education provides an advantage.

While these results show that placement in upper secondary schools is highly consequential for early labor market outcomes, they conceal the underlying heterogeneity among tracks within academic upper secondary education. To investigate this heterogeneity, Model 2 in Table 2 reports the returns to different academic upper secondary tracks (relative to leaving the educational system after lower secondary school) controlling and not controlling for confounders. We find considerable differences among the different academic upper secondary tracks in Panel A, and while controlling for confounders substantially reduces the gross

associations, the overall pattern in returns is maintained in Panel B. For example, completing either the STX mathematics track or the technical track (HTX) increases the probability of entering the service class by about 39 percentage points compared to the reference category, which is much larger than the average return of 28 percentage points for all academic tracks (see Model 1 vs. 2 in Panel B). The short-term (HF) and mercantile (HHX) tracks have the lowest returns, close to 20 percentage points, i.e., only half the effect of attending the mathematics or technical track. For unemployment, the differentiation between the different academic upper secondary tracks is less consequential, while the differences in terms of income are noteworthy. Here, the returns to a mercantile (HTX) track are 31 percent, similar to that for the technical track (30 percent) and STX mathematics track (28 percent). Earnings returns are lowest for the STX language track (16 percent) and the short-term (HF) track (13 percent). These differences in returns pertain to earnings measured at age 30 and may not extend into occupational maturity (Birkelund, Karlson and Reimer 2019).

Returns to upper secondary track placement and higher education attainment

To answer RQ2, Models 3–5 in Table 2 report estimates of track returns after we control for crude (three tertiary education levels, Model 3), detailed (tertiary level and field of study, Model 4), and extremely detailed (817 degree programs, Model 5) measures of higher education attainment. Here we focus on the estimates in Panel B, as they show the extent to which these higher education variables mediate the net returns to track placement. A comparison of the estimates in Models 2 and 3 indicates that the attained level of tertiary education mediates a significant portion of the net tracking returns across all labor market outcomes. For example, for access to the service class, the crude higher education indicator reduces the track returns by 50–70 percent, suggesting a substantial degree of mediation. We find a similar pattern for the other

labor market outcomes. However, across the three labor market outcomes, we also find that even among individuals with similar levels of higher education, attending an academic upper secondary track still affects labor market outcomes. This pattern of results suggests that the academic upper secondary tracks directly affect labor market outcomes, thus shaping labor market outcomes independently of the skills and preferences acquired in higher education.

To further study the mediating impact of tertiary education, Model 4 controls for the more detailed tertiary education variables (field of study). Although we see some differences compared to the estimates in Model 3, the overall pattern is very similar across all labor market outcomes. Nevertheless, for some tracks, the estimates increase slightly from Models 3 through 4, suggesting that field of study captures a different kind of heterogeneity than overall tertiary education levels. Controlling for an even more detailed measure of higher education attainment in Model 5, we find that for some labor market outcomes, the effects of upper secondary track placements are further reduced compared to the estimates in Model 3, while this is not the case for other outcomes. For example, for entry into the service class, many of the estimates are substantially reduced, suggesting that a very detailed measure of higher education mediates a substantial portion of the net effects reported in Model 2.

In contrast, the effect estimates for unemployment are largely unaffected by including a more detailed indicator, suggesting that the key entry factor to the labor market is to have obtained a degree rather than having a specific specialization. Moreover, direct effects in Model 5 across all labor market outcomes clearly suggests that higher education, even measured at a very granular level, cannot fully account for the association between upper secondary tracks and labor market outcomes. This finding suggests that while educational pathway mechanisms partly account for why upper secondary tracking affects labor market outcomes, learning or signaling

mechanisms also appear to account for part of the effect. For example, having completed a STX math track may signal productivity to potential employers even among candidates with similar higher education degrees.

Track placement as a mediator of the association between origins and destinations

Finally, we address our third research question and examine to what extent track placement mediates the relationship between students' social origin and their labor market outcomes. Table 3 reports how much of the gap in outcomes at labor market entry by parental education is mediated by lower secondary school GPA and upper secondary track placements. Model 1 shows the unconditional or raw gaps, with the reference category being parents having completed a tertiary education degree. The estimates show very pronounced effects of family background on early labor market outcomes. For example, children born to low-educated parents (no more than compulsory schooling) have a 36 percentage points lower probability of holding a service class position at age 30 compared to children born to parents with a higher education. They are also nine percentage points more likely to be unemployed, and they earn on average 20 percent less at age 30.

[TABLE 3 ABOUT HERE]

Model 2 in Table 3 shows the results of a mediation analysis (Baron and Kenny 1986). We examine the percentage of the gaps by parental education accounted for by lower secondary school GPA. By adding the GPA covariate to the linear regression model, we calculate how much the coefficients for the parental education variable decrease in magnitude, which we interpret as the degree to which the influence of parental education on labor market outcomes is mediated by academic performance. For all outcomes, the gaps are reduced significantly. For the parental compulsory–tertiary education contrast, the gap is reduced by about 50 percent, and for

the parental upper secondary–tertiary education contrast, the percentage mediated ranges from around 50 percent to over 100 percent (meaning that the gap is fully mediated by GPA). These results point to the role of early skill formation processes (Heckman 2006; Shonkoff and Phillips 2000) and to the importance of considering academic performance when studying social background inequalities in educational attainment (Erikson et al, 2005).

In Model 3, we report the percent mediated after we, in addition to GPA, control for our detailed upper secondary track indicator (i.e., controlling for both GPA and track indicator). We find that across most labor market outcomes and gaps, the track indicator accounts for additionally explained portions of the family background gaps.[7] For example, considering service class destinations, the incrementally explained gap is 18 and 15 percentage points for the two gaps. These results suggest that track placement plays a role in intergenerational reproduction *over and above* the role of academic performance (and the underlying skills that this performance reflects).

Sensitivity analysis: *results at occupational maturity and over time*

A limitation of the analysis presented is that we measure labor market attainment at a relatively early point in the career, at age 30. To examine whether the pattern of results hold for labor market outcomes measured at occupational maturity and whether the pattern is constant across time, we estimate the association between upper secondary track placement and labor market outcomes at age 40 across fifteen birth cohorts born 1962–1976 (see Supplementary material B, Birkelund, Karlson and Reimer 2020). As we cannot control for differences in pre-track academic performance for these cohorts, we instead apply a sibling (or family) fixed-effects design that controls for all unmeasured family heterogeneity as well as for gender and sibling birth order. The results indicate that the pattern of results found for the 1986 cohort (at age 30)

can largely be replicated for the older cohorts (at age 40) and that findings are remarkably stable over time. However, the gap between vocational and academic upper secondary education in terms of earnings is more pronounced at age 40. Furthermore, the internal differentiation of academic upper secondary tracks is also associated with more pronounced income differentials at age 40.

Discussion

This paper presents a comprehensive analysis of the labor market returns to upper secondary track placement in Denmark, a country with high public spending on education and an inclusive, late-tracking educational system. We examined three overarching research questions. With respect to our *first research question*, we find that even when we control for the non-random selection of students into tracks on pre-track academic performance and family background characteristics, there are pronounced returns to attending upper secondary school (relative to leaving the educational system after lower secondary school). While our analyses are based on a relatively early point in our focal (1986) cohort's life course at age 30, sensitivity analyses based on older cohorts (born between 1962–1976) when individuals had reached occupational maturity at age 40 showed a highly similar relationship between upper secondary tracking and labor market outcomes across these cohorts.

The analyses addressing our *second research question* revealed that the returns to academic upper secondary track placement are substantially mediated by the choice of higher education type as well as field of study. Nevertheless, even when accounting for very detailed indicators for tertiary level program attainment, track choices have net effects on all of the labor market outcomes considered. This finding illustrates that a differential pathway mechanism cannot fully account for the reported tracking effects, suggesting that mechanisms related to

differential learning or differential signaling also are operating. For example, employers may screen candidates using information on the track placement in upper secondary schools, indirectly inferring which qualities the candidate has in terms of productivity.

Finally, the analyses with respect to our *third research question* showed that upper secondary track placement independently mediates the association between family background and labor market net of students' pre-tracking academic performance. Nevertheless, grade differentials between individuals with different parental education background account for substantial portions of the observed gaps. This shows that the mediating role of track placement cannot be reduced to a question of the uneven distribution of skills among the social classes, nor to a question of selection effects into tracks on skills.

By analyzing the relationship between upper secondary tracking and multiple labor market outcomes, our paper addressed a shortcoming of previous studies, which often only examine singular dimensions of labor market success. Our results reveal considerable heterogeneity across the three different labor market outcomes. While *academic* upper secondary education strongly affects access to service class (I+II) jobs, *vocational* upper secondary degrees act as a powerful protection from unemployment. Moreover, at age 30, the earnings returns to the two tracks are roughly similar. These results are consistent with results reported for other dual systems, showing that vocational education functions as an effective safety net against unemployment, while not offering advantages for access to higher-level occupational positions (Shavit and Müller, 2000).

We also show that among tracks in the academic stream in upper secondary schools (which cover tracking both within and between schools), labor market returns vary significantly. For example, the service class returns to completing the academic mathematics track in the regular

gymnasium (STX) or the technical track (HTX) are almost twice as large as those pertaining to completing the mercantile track (HHX) or the two-year late-starter track (HF). These returns differences among tracks also show the importance of measuring track placements at a very detailed level. Had we not measured placements with such detail, we would not have been able to reveal the sizable heterogeneity in returns.

Our study has a number of limitations. While our results clearly show that upper secondary tracking effects are not solely attributable to selection effects, we cannot disentangle which of the discussed mechanisms are generating the tracking returns. Completion of different upper secondary tracks might very well be perceived as a strong signal—or stigma—that provides additional information for future productivity. Alternatively, the different types of tracks lead to differences in learning gains and ultimately in human capital that pay off in the labor market. Further research should tackle these questions, possibly with research designs that measure both students' and employers' views of the different tracks. Our study is further limited by our inability to estimate the causal effects of track placement and thus identify the true labor market returns to upper secondary school tracking. While we control for pre-track academic performance and family background characteristics, students likely select into tracks on the basis of unobserved variables (unobserved by us), such as aspirations and personality traits that are not captured by our GPA measure. Insofar as such unobserved variables are positively correlated with both track placements and market outcomes, our estimated returns are likely too large (i.e., they are upper-bound estimates to the true returns). Nevertheless, the net returns we report in this paper are substantial, particularly for some tracks, meaning that the degree of confounding by unobserved variables would have to be quite large in order for it to reduce our estimates to zero.

Considered together, our results provide insights into the role of tracking in upper secondary education for labor market returns in Denmark. Even in a late-tracking and egalitarian school system such as that in Denmark, upper secondary tracking plays a significant role in differentiating life outcomes and in reproducing inequalities across generations, pointing to the likelihood that even more pronounced differences than we report here may be found in countries with less equalizing institutions.

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Tables and Figures

Table 1. Descriptive statistics

	N	Mean	Std. dev.	Min	Max
Upper secondary education	43,972				
None		0.149			
Vocational		0.291			
Academic: Mathematics (STX)		0.180			
Academic: Language (STX)		0.129			
Academic: Short-term (HF)		0.086			
Academic: Mercantile (HHX)		0.124			
Academic: Technical (HTX)		0.042			
Gender	43,972				
Man		0.505			
Woman		0.495			
Ethnicity	43,972				
Danish origin		0.961			
Immigrant		0.011			
Second generation immigrant		0.028			
Family type	43,972				
Intact family		0.692			
Reconstituted family		0.129			
Single parent		0.168			
No parents		0.011			
Parental education					
Tertiary		0.388			
Upper secondary		0.486			
Compulsory		0.126			
Parental social class					
I+II Service		0.419			
IIIab Routine non-manual		0.314			
IVab Self-employed		0.049			
IVc Farmers		0.015			
V+VI Skilled manual		0.081			
VIIab Unskilled manual		0.122			
Parental income rank	43,972	0.500	0.289	0	1
Number of siblings	43,972	1.548	0.988	0	13
Compulsory school GPA	43,972	0.000	1.000	-7.5	3.8
Outcome variables at age 30:					
I+II Service class	36,105	0.462	0.499	0	1
Unemployment	41,149	0.083	0.276	0	1
Earnings, 1,000 €	38,595	44.277	20.146	1	680.9

Table 2. OLS models regressing outcomes at labor market entry on educational attainment (unstandardized coefficients).

	A. Uncontrolled estimates		B. Controlled for selection into tracks				
	Model 1 (Upper sec. level)	Model 2 (+Upper sec. track)	Model 1 (Upper sec. level)	Model 2 (+Upper sec. track)	Model 3 (+Tertiary level)	Model 4 (+Tertiary field of study)	Model 5 (+Tertiary detailed education)
Outcome: Service class							
Upper secondary education (None)							
Vocational	0.008	0.008	-0.009	-0.006	0.021**	0.003	-0.010
Academic	0.491***		0.275***				
Academic: Mathematics (STX)		0.625***		0.393***	0.181***	0.139***	0.085***
Academic: Language (STX)		0.522***		0.329***	0.130***	0.135***	0.079***
Academic: Short-term (HF)		0.297***		0.205***	0.059***	0.071***	0.065***
Academic: Mercantile (HHX)		0.354***		0.224***	0.098***	0.127***	0.100***
Academic: Technical (HTX)		0.568***		0.394***	0.206***	0.141***	0.092***
Constant	0.164***	0.164***					
N	36105	36105	36105	36105	36105	36105	36105
R^2	0.226	0.265	0.286	0.298	0.373	0.420	0.525
Outcome: Unemployment							
Upper secondary education (None)							
Vocational	-0.206***	-0.206***	-0.187***	-0.188***	-0.189***	-0.190***	-0.191***
Academic	-0.222***		-0.172***				
Academic: Mathematics (STX)		-0.236***		-0.173***	-0.145***	-0.142***	-0.143***
Academic: Language (STX)		-0.217***		-0.173***	-0.143***	-0.145***	-0.148***
Academic: Short-term (HF)		-0.170***		-0.149***	-0.121***	-0.118***	-0.121***
Academic: Mercantile (HHX)		-0.234***		-0.192***	-0.169***	-0.170***	-0.171***
Academic: Technical (HTX)		-0.236***		-0.171***	-0.142***	-0.145***	-0.146***
Constant	0.270***	0.270***					
N	41149	41149	41149	41149	41149	41149	41149
R^2	0.072	0.076	0.094	0.095	0.102	0.107	0.134
Outcome: Log earnings							
Upper secondary education (None)							
Vocational	0.267***	0.267***	0.231***	0.233***	0.240***	0.234***	0.231***
Academic	0.357***		0.232***				
Academic: Mathematics (STX)		0.460***		0.282***	0.203***	0.192***	0.179***
Academic: Language (STX)		0.243***		0.162***	0.089***	0.133***	0.153***
Academic: Short-term (HF)		0.140***		0.128***	0.076***	0.087***	0.102***
Academic: Mercantile (HHX)		0.406***		0.309***	0.260***	0.247***	0.238***
Academic: Technical (HTX)		0.515***		0.297***	0.228***	0.206***	0.185***
Constant	10.264***	10.264***					
N	38595	38595	38595	38595	38595	38595	38595
R^2	0.029	0.051	0.102	0.109	0.115	0.133	0.197

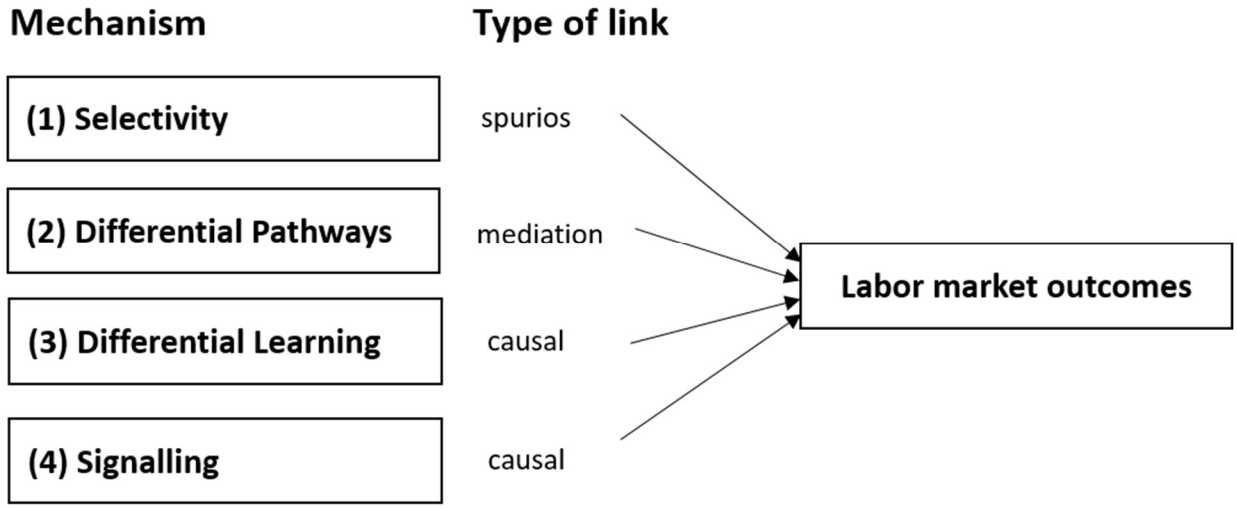
* p<0.05, ** p<0.01, *** p<0.001

Table 3. Average gaps in labor market outcomes at age 30 by parental education, and percent mediated by academic performance and upper secondary track placement.

	Model 1 (Uncontrolled estimates)	Model 2 (+Compulsory school GPA)	Model 3 (+Upper sec. track)
Outcome: Service class			
Parental education (Tertiary)			
Upper secondary	-0.244***	52%	70%
Compulsory	-0.359***	59%	74%
N	36105	36105	36105
R2	0.073	0.235	0.294
Outcome: Unemployment			
Parental education (Tertiary)			
Upper secondary	0.019***	>100%	>100%
Compulsory	0.091***	46%	60%
N	41149	41149	41149
R2	0.010	0.031	0.082
Outcome: Log earnings			
Parental education (Tertiary)			
Upper secondary	-0.061***	100%	85%
Compulsory	-0.195***	53%	57%
N	38595	38595	38595
R2	0.008	0.031	0.061

Note: Gaps estimated by linear regression.
* p<0.05, ** p<0.01, *** p<0.001

Figure 1. Four mechanisms that can explain the association between tracking and labor market outcomes.



[Online supplements to article in *Longitudinal and Life Course Studies*]

Upper secondary school tracking, labour market outcomes and intergenerational inequality in Denmark

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Supplement A: Typical flows between upper secondary tracks and tertiary education (page 1)

Supplement B: Labour market returns at occupational maturity and over time (pages 2-7)

Supplement A: Typical flows between upper secondary tracks and tertiary education

Table A1. Association between academic upper secondary track type and tertiary education level (1986 birth cohort, N=24,637).

	Mathematics (STX)	Language (STX)	Short-term (HF)	Mercantile (HHX)	Technical (HTX)	Academic total
No tertiary education	11.3	14.8	36.1	35.8	22.5	22.2
Short-cycle tertiary	5.2	5.4	8.3	14.2	9.8	8.0
Medium-cycle tertiary	30.5	40.1	45.0	28.8	33.3	34.8
University	53.1	39.8	10.6	21.2	34.5	35.1
Total	100	100	100	100	100	100

Table A2. Association between academic upper secondary track type and tertiary field of study (1986 birth cohort, N=24,637).

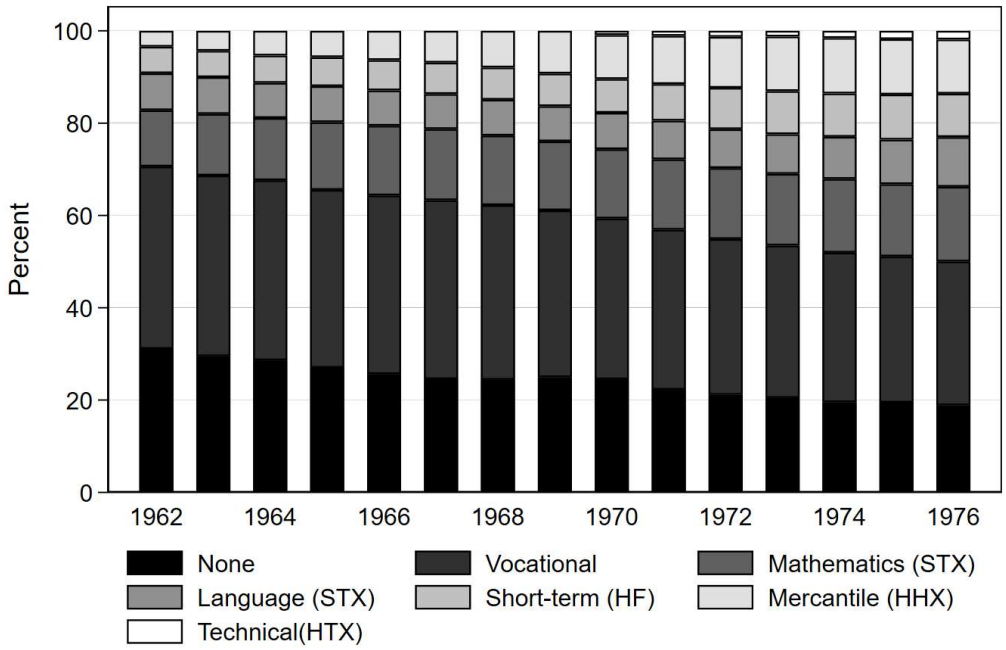
	Mathematics (STX)	Language (STX)	Short-term (HF)	Mercantile (HHX)	Technical (HTX)	Academic total
No tertiary education	11.3	14.8	36.1	35.8	22.5	22.2
Humanities	6.7	18.2	5.7	3.6	2.2	8.2
Social sciences	7.2	8.5	2.0	2.6	1.7	5.2
Law	3.6	3.9	0.9	2.1	0.7	2.7
Business	13.8	11.2	6.4	31.2	8.0	15.5
Natural sciences	8.8	0.9	0.4	0.3	5.1	3.5
Engineering	16.9	4.9	5.0	3.8	40.8	11.2
Health	18.5	15.1	12.7	4.9	7.2	13.0
Teacher, educator or social worker	7.9	16.7	25.3	10.5	5.1	13.0
Total	100	100	100	100	100	100

Supplement B: Labour market returns at occupational maturity and over time

Since we can only examine outcomes during the labour market entry phase for our focal birth cohort, we present a set of additional analyses, for a much larger sample consisting of persons born from 1962 through 1976. This sample enables us to examine patterns in the returns by track placement at age 40 when most individuals typically have reached occupational maturity (Bukodi and Goldthorpe, 2011), and to examine whether the pattern in returns is constant across time. While we do not have a pre-track academic performance measure for these cohorts, we exploit the sibling information to estimate sibling fixed effects models, which allows us to control the track effects for all stable, unobserved traits and characteristics that siblings share (Angrist and Pischke, 2009). Such traits and characteristics include genetic makeup, parental rearing styles and resources, and the surrounding neighborhood environment. Although we cannot control for differences in abilities and preferences among siblings from the same family in the sibling fixed effect models we estimate, this model provides a good entry into comparing controlling for unmeasured variables affecting both track placement and labour market outcomes. Beyond controlling for all unmeasured family heterogeneity, the models also control for gender and sibling birth order. The sibling sample consists of 1.060.822 individuals born between 1962 and 1976 with at least one sibling born in the same period, corresponding to about 70.000 individuals per birth year.

Figure B1 shows changes in the distribution of upper secondary tracks over the 15-year birth cohort span. We observe a steep increase in the proportion of students obtaining an academic upper secondary degree. While 29 percent of individuals born in the 1962 cohort obtained an academic degree, 50 percent did so in the 1976 cohort.

Figure B1. Distribution of upper secondary tracks by year of birth



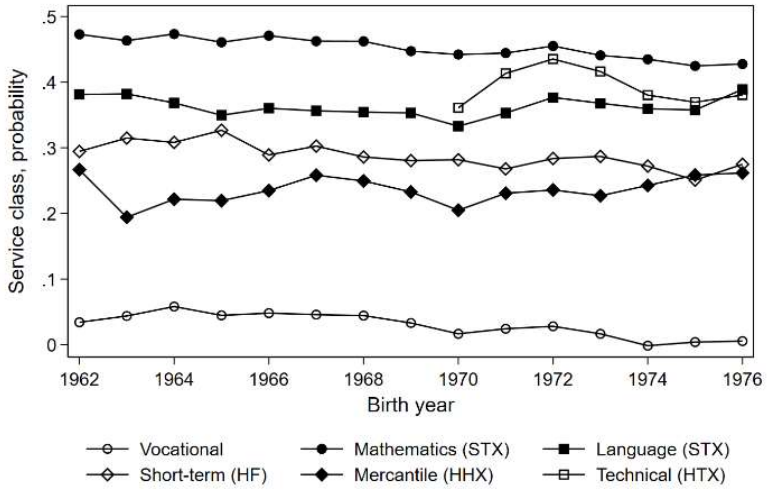
To investigate whether these dramatic changes to the distribution affect the returns to track placement, in Figure B2 we report for the five labour market outcomes the estimated returns based on our sibling fixed effects model (Figure B3 shows the marginal distributions of the labour market outcomes by birth cohorts). Figure B2 shows widespread stability in the relative labour market returns to different tracks over time, and the track pattern in returns is very similar to that reported for the 1986 cohort. For example, the service class returns to STX mathematics track placement are close to 50 percentage points and they remain stable across the 15 cohorts. Similarly, the vocational track has by far the lowest service class returns, close to 5 percentage points. This result suggests that, at occupational maturity, the returns vary by a factor of about 10 between the two most extreme tracks in terms of service class returns. While this factor is lower for the other outcomes, it is still quite pronounced. For earnings, the return is about 45 percent for completing the STX mathematics track and only about 15 percent for the vocational track. We cannot confirm, however, that the relative differences between the academic tracks (Mathematics, Language,

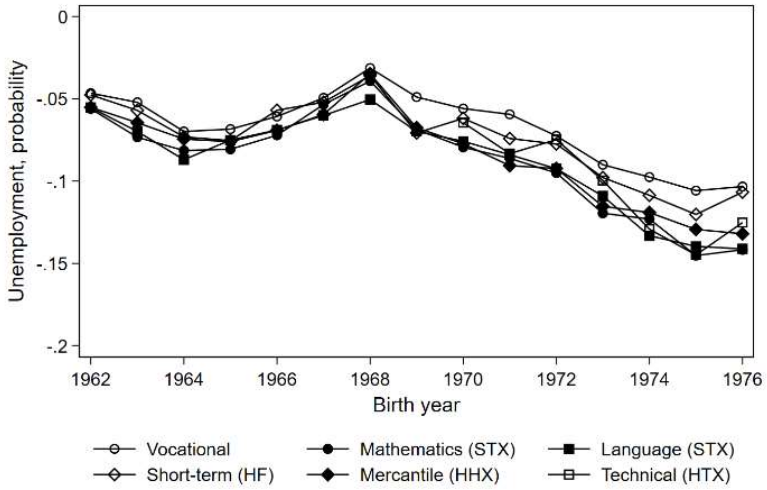
Mercantile and Technical) increase over time, which is quite remarkable given the pronounced expansion of academic upper secondary education in the period considered.

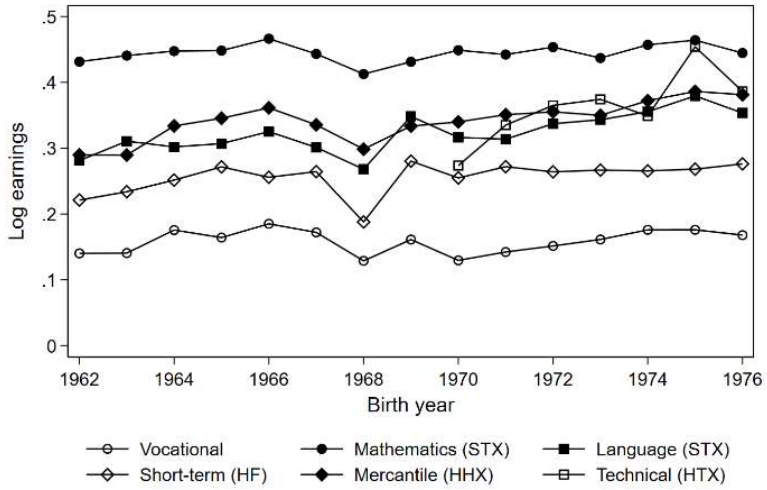
The largest change in the returns to educational tracks is observed for unemployment risk. For all academic tracks, we find a large decrease in the risk of unemployment relative to no upper secondary education and, with the exception of the short-term (HF) track, a minor decrease in the risk relative to the vocational track. Thus, over time, academic upper secondary education appears to become a strong protection against the risk of unemployment, while this risk increasingly concentrates among those without any formal schooling beyond compulsory lower secondary education.

Given the considerable changes in the relative proportion of individual from the different cohorts choosing different tracks, the observed stability of returns to upper secondary tracks is remarkable. In light of the growth of academic upper secondary education over time, we can assume that the composition of individuals—in terms of ability, motivation, and other variables—choosing the different tracks will have changed substantially. This result further underlines that an explanation for upper-secondary tracking effects purely based on "selectivity" (cf. RQ 1) does not fit the Danish country case. The result also contradicts the popular sociological thesis which states that qualitative differentiation within a level of schooling (here academic upper secondary education) becomes more relevant for further outcomes once more individuals reach that level (Lucas, 2001).

Figure B2. Cohort trends in upper secondary track effects (relative to no upper secondary education), 1962–1976, on service class position, unemployment, and log earnings.

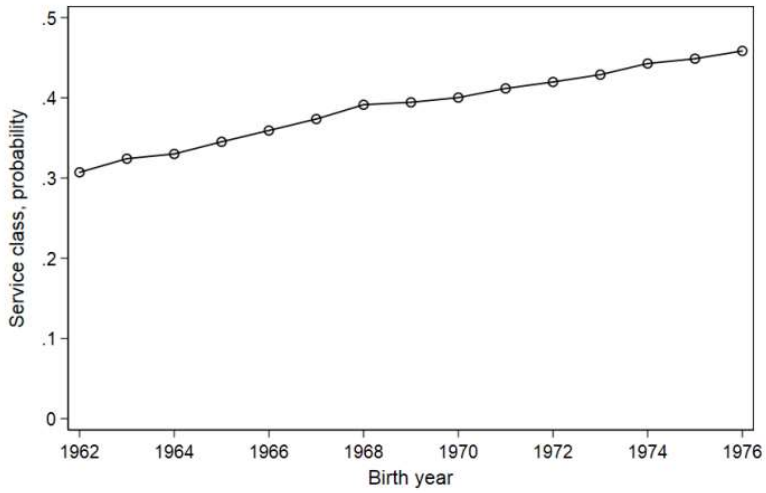


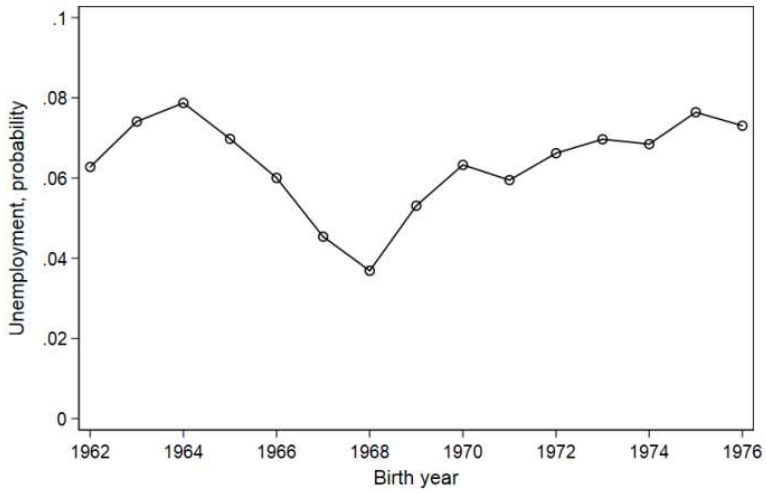


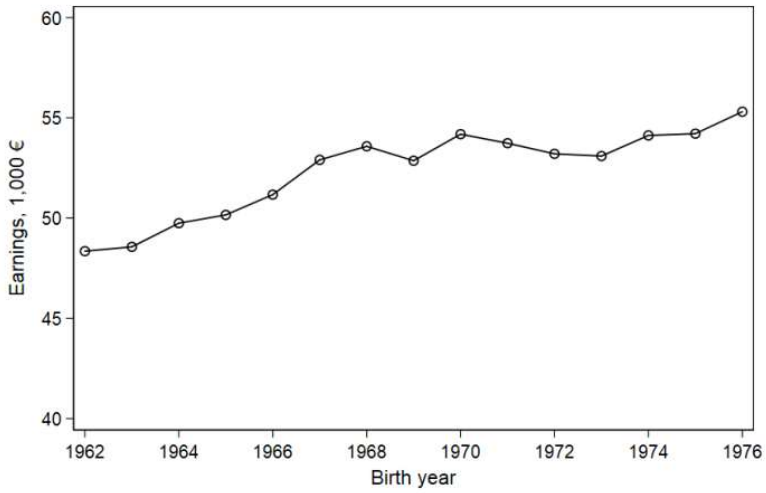


Note: Estimates controlled for sibling fixed effects.

Figure B3. Marginal distributions of labour market outcomes over time.







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Endnotes

[1] While the vast majority of children attend high quality pre-school daycare institutions, a smaller share attend a lower quality type of daycare with private caretakers who care for children at their own home (Esping-Andersen et al. 2012: 579).

[2] Upon completing grade nine, students can choose an optional grade ten, which is also part of lower secondary schooling. Moreover, while most students attend a public comprehensive school (*Folkeskole*), a non-trivial share of students attend private schools (*Frie grundskoler*), which are also subsidized by the state and are required by law to offer the same core curriculum as public schools. These private schools are very diverse and range from elite schools in the large cities to regular schools in rural areas, and schools emphasizing non-mainstream approaches to learning and teaching.

[3] Upon completing vocational upper secondary education, students can also enrol in some programs of short-cycle and medium-cycle higher education, although this occurs only rarely.

[4] Most of the missing information results from a group of individuals who did not complete compulsory schooling and thus did not obtain a GPA.

[5] Students born in 1986 who enrolled in the traditional academic track (STX) had to choose between a focus on either advanced mathematics and science subjects or advanced foreign language subjects in addition to the core curriculum. The mathematics track (18 percent of students) was slightly more popular than the language track (13 percent of students).

[6] Models 3–5 further control for different indicators of tertiary education level, results to which we return in a later section.

[7] For the parental upper secondary–tertiary contrast in log earnings, the percent mediated declines when additionally controlling for upper secondary track placement, indicating that for this specific contrast track placement acts as a suppressor. However, this suppression effect is quite small.