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Published in:
Social Science Research

DOI:
10.1016/j.ssresearch.2013.06.001

Publication date:
2013

Document version
Peer reviewed version

Document license:
Unspecified

Citation for published version (APA):
Holm, A., Jæger, M. M., Karlson, K. B., & Reimer, D. (2013). Incomplete equalization: the effect of tracking in secondary education on educational inequality. *Social Science Research*, *42*(6), 1431-1442. https://doi.org/10.1016/j.ssresearch.2013.06.001

Incomplete Equalization:
The Effect of Tracking in Secondary Education on Educational Inequality

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THIS PAPER IS PUBLISHED IN

SOCIAL SCIENCE RESEARCH 2012, 42(6):1431-42

Access paper here:
http://www.sciencedirect.com/science/article/pii/S0049089X13000860

9308 words (including all text, notes, and references)
3 tables

Acknowledgements: We thank the reviewers for very helpful comments and participants at the following events for constructive suggestions: The 2009 RC28 Summer Meeting at Yale University, the 2010 TIY conference in Dublin, the 2010 SUNSTRAT Meeting at Stockholm University, the inequality workshop at the 2011 Danish Sociological Congress, the 2011 Conference in the Nordic Sociological Association, the 2012 meeting at the Aarhus Business School Department of Economics Seminar, and finally the 2012 Annual SFI Conference. We also thank Stephen Jenkins for his many constructive comments and Stine Møllegaard Pedersen and Anders Purup Trolle for excellent research assistance. We gratefully acknowledge funding from the Danish Strategic Research Council (Grant No. 2139-08-002).

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Abstract

This paper tests whether the existence of vocationally oriented tracks within a traditionally academically oriented upper education system reduces socioeconomic inequalities in educational attainment. Based on a statistical model of educational transitions and data on two entire cohorts of Danish youth, we find that (1) the vocationally oriented tracks are less socially selective than the traditional academic track; (2) attending the vocationally oriented tracks has a negative effect on the likelihood of enrolling in higher education; and (3) in the aggregate the vocationally oriented tracks improve access to lower-tier higher education for low-SES students. These findings point to an interesting paradox in that tracking has adverse effects at the micro level but equalizes educational opportunities at the macro level. We also discuss whether similar mechanisms might exist in other educational systems.

1. Introduction

Research on educational inequality suggests that the institutional organization of educational systems contributes to inequalities in educational outcomes. In particular, the role of educational tracking in creating or maintaining educational inequalities has received considerable attention in the literature, not least due to the widespread use of tracking in most Western countries.

In the US, a large body of research has analyzed the social selectivity of different curricular tracks in secondary schools and, net of selectivity, the effect of these tracks on educational achievement and attainment (Gamoran 2010). This literature suggests that while being placed in an academically (vs. a non-academically) oriented track does not increase overall academic achievement, it widens between-track gaps in achievement over the course of high school (e.g., Alexander et al. 1978; Gamoran and Mare 1989; Heyns 1974; Lucas 1999; Lucas and Gamoran 2002). Furthermore, because students from advantaged socioeconomic backgrounds are more likely than those from less advantaged backgrounds to be placed in academically oriented tracks, tracking has generally been regarded as reinforcing preexisting socioeconomic inequalities in educational outcomes (Shavit and Müller 2006). Results similar to those for the US have also been reported for Japan (Ono 2001) and Israel (Ayalon 2006), and in Europe a concomitant literature has analyzed how the diverse institutional features of secondary education systems in this region, including tracking, contribute to socioeconomic inequalities in educational outcomes (e.g., Hall 2012; Hillmert and Jacob 2010; Ichou and Vallet 2011; Tieben and Wolbers 2010; Wagner et al. 2011).

This paper analyzes the effect of track placement in upper secondary education in Denmark on the likelihood that students continue in higher education. Specifically, the paper tests if the existence of two vocationally oriented tracks, a mercantile and a technical

track, within a traditionally academically oriented upper secondary education system promotes educational mobility by attracting students who would not normally acquire the upper secondary credentials needed to proceed to higher education (Erikson and Hansen 1987). Our analysis sheds new light on the role of tracking with regard to maintaining or reducing socioeconomic inequalities in educational outcomes, and we contribute to existing research in three important regards.

Our first contribution is that we analyze the effect of tracking in an institutional context, Denmark, in which tracking in secondary education has significant and largely irreversible consequences for students' educational careers. Although in many regards similar to the equality-oriented educational systems in the other Scandinavian countries, the Danish educational system has a "Germanic" legacy which includes strong tracking after compulsory school. Upon completion of compulsory school at around age 16, students must choose between either leaving school or entering vocational education or academic upper secondary education. These two tracks are completely different with regard to curriculum, and only the academic track offers students the possibility of continuing in higher education. As a consequence, the choice of educational track at the end of compulsory school has significant long-term consequences for students and their families. The introduction of two vocationally oriented tracks within upper secondary education in the 1970s and 1980s, a mercantile and a technical track, resulted in a less clear dichotomy between vocational and academic secondary orientation. The political motivation for introducing these tracks was to encourage students from disadvantaged socioeconomic backgrounds to acquire upper secondary education credentials that would enable them to continue into higher education. We analyze whether these tracks promote educational mobility, first, by attracting students who would not

otherwise have acquired upper secondary education credential and, second, by increasing the likelihood that these students continue in higher education.

The second contribution of this paper is that it develops a statistical model that distinguishes the effect of socioeconomic background on track placement (selection effect) from the effect of track placement itself on educational outcomes (tracking effect). The importance of distinguishing between selection effects and tracking effects was emphasized in seminal work by Alexander and colleagues (Alexander and Cook 1982; Alexander et al. 1978; Alexander and McDill 1976) and by Gamoran and Mare (1989) and Lucas and Gamoran (2002). Yet, most empirical work does not distinguish these processes and does not take into account that educational decisions may depend on unobserved as well as on observed variables. We propose an educational transition model which jointly models students' choice of track in secondary education (none, vocational, vocational upper secondary or academic upper secondary) and their decision about whether or not to continue in higher education. Our model accounts for unobserved between-student heterogeneity by allocating students into latent subgroups which differ with regard to their propensity of making each educational transition. This essentially means that we allow for correlated errors across tracks and transitions. The correlated errors take into account unobservables affecting choice of track and whether to continue in further education. Our model is identified from explanatory variables that vary across educational transitions and from credible exclusion restrictions, and it provides a stronger empirical basis for analyzing the effect of tracking on educational outcomes than previous research.

The third contribution of this paper is that it uses the empirical results to assess effects of educational tracking on educational inequality at the population level. Our approach is inspired by recent research on assortative mating which uses counterfactual calculations to

evaluate the consequences at the macro level of changes in behaviors at the micro level (e.g., Mare and Maralani 2006). Specifically, we use our empirical results and counterfactual simulations to analyze the "what if" consequences of hypothetically closing down the vocationally oriented tracks in Danish upper secondary education. Which educational pathways would students who chose the vocationally oriented tracks have chosen had these alternatives not existed? We recover the counterfactual distributions of educational outcomes and analyze the extent to which the existence of the vocationally oriented tracks in upper secondary education contributes to maintaining or reducing socioeconomic inequalities in educational outcomes.

We report three main findings. First, similar to previous research, we find that socioeconomic background is strongly related to track placement. Specifically, we find that students from advantaged socioeconomic backgrounds are much more likely to enter the vocationally oriented and academic tracks in upper secondary education compared to those from less advantaged backgrounds. Second, we find that although the vocationally oriented tracks in upper secondary education attract students who would not otherwise have acquired upper secondary education credentials, being in the vocationally oriented tracks rather than in the traditional academic track has a significant negative effect on the likelihood of subsequently enrolling in higher education. Our findings thus suggest that the vocationally oriented track works in two opposing ways: it provides more students from disadvantaged backgrounds with upper-secondary level credentials (thereby reducing inequality in access to upper secondary education), but it also decreases the likelihood that these students continue in higher education (thereby increasing inequality in access to higher education). Third, despite the opposing effects of the vocationally oriented track on educational mobility, we find that in the aggregate the vocationally oriented track lowers socioeconomic inequalities in higher

education enrollment. Our counterfactual simulations thus suggest that socioeconomic inequalities would have been higher had the vocationally oriented tracks not existed.

2. Theoretical background

2.1 Educational tracking

Most educational systems include some form of tracking of students in compulsory or secondary education. Tracking involves curricular differentiation or ability grouping and it exposes students to different institutional environments, learning opportunities, peer groups, and social expectations (e.g., Kerckhoff 1993; Lucas 2001; Shavit and Müller 2006).

Scholars usually distinguish two dimensions of tracking: Sorting of students into tracks and the outcomes associated with attending a particular educational track (Sørensen 1970). Research shows that sorting into tracks is in part contingent upon socioeconomic background, with students from privileged backgrounds being more likely to attend academic (rather than vocational) tracks compared to students from less privileged backgrounds (e.g., Buchmann and Park 2009; Jones, Vanfossen, & Ensminger, 1995; Kerckhoff 1993; Lucas 1999; Shavit 1984). Studies also report widening between-track achievement gaps over the high school years (e.g., Alexander, Cook and McDill 1978; Gamoran 1992; Gamoran and Mare 1989; Heyns 1974; Lucas and Gamoran 2002) and furthermore that placement in academically oriented tracks has a positive effect on subsequent educational outcomes (e.g., Dustmann 2004; Gamoran and Mare 1989; Lucas 1999, 2001). The reasons why tracking affects educational outcomes has been hypothesized to be related to the differential provision of learning opportunities, peer influences, and the social stigma associated with being placed in different tracks (e.g., Gamoran 1986; Oakes 1986, 2005; Pallas et al. 1994; Rosenbaum 1976; Sørensen 1984). Additonally, in many educational systems placement into 'dead-end'

tracks restrict opportunities for further advancement in the educational system and access to higher education. In their seminal study, Gamoran and Mare (1989) argued that tracking may reinforce, be neutral to, or reduce socioeconomic inequalities in educational outcomes. They found that tracking in secondary schools in the US reinforces inequalities in math achievement, a result that was later corroborated with updated data and different track indicators (Lucas and Gamoran 2002). However, because countries differ with regard to tracking regimes, the question is whether these findings also apply in other contexts. The role of tracking in the reproduction of educational inequalities will depend on the institutional setup of the educational system and, in particular, on how early in their educational career students are tracked (e.g., Breen and Jonsson 2000; Buchmann and Park 2009; Hanushek and Wößmann 2006; Kerckhoff 2001; Shavit and Müller 2000). Below, we argue that the structure of tracking in Danish secondary education is likely to have a strong impact on educational inequality.

2.2 Selection effects versus tracking effects

A crucial insight from previous research is the need to distinguish between the selection of students into different educational tracks and, conditional on this sorting, the effect of track placement on educational outcomes (Gamoran and Mare 1989). Both processes are important for understanding how educational systems contribute to the reproduction of educational and socioeconomic inequalities.

In this paper we seek to empirically distinguish between selection effects and tracking effects and furthermore to analyze whether the existence of vocationally oriented tracks in upper secondary education in Denmark reduces or reinforces educational inequalities. Using the terminology of Brint and Karabel (1989) and Arum and et al. (2007),

we are interested in analyzing whether the vocationally oriented tracks lead to an *inclusion* of previously disadvantaged students or to a *diversion* away from favorable educational opportunities. Research from Europe suggests that vocationally oriented educational tracks divert students away from university-bound tracks; a diversion that in turn reinforces socioeconomic inequalities in educational outcomes (e.g., Hillmert and Jacob 2010; Schindler and Reimer 2011; Shavit and Müller 2006). This argument is consistent with the Effectively Maintained Inequality (EMI) hypothesis, which suggests that—at comparable levels of education—students from advantaged socioeconomic backgrounds tend to enroll educational tracks with larger future payoffs compared to students from less advantaged backgrounds (Lucas 2001).

The main challenge in our analysis is to establish the counterfactual outcomes for students in different types of upper secondary education: what would students who did choose the vocational track in upper secondary education have chosen had this track not existed? Would they opt for the traditional academic track in order to gain access to higher education or would they instead opt for vocational education? And, knowing the socioeconomic composition of the group of students who did choose the vocationally oriented tracks in upper secondary education, would their counterfactual outcomes result in more or less inequality in educational outcomes?

In order to answer these questions we need to, first, estimate a statistical model which provides empirical estimates of transition rates into different educational tracks given socioeconomic background and, second, use these estimates to calculate counterfactual distributions of educational choices had the vocationally oriented tracks in upper secondary education not existed. The statistical model which we employ is a multinomial transition model, which—in addition to observable characteristics of students and their families—also

takes unobserved characteristics into account. By doing so, we hope to account for the factors that determine selection into different educational tracks. Our method for calculating counterfactual distributions of educational choices is described in detail below, but before turning to the methodological approach we first present the structure of the Danish educational system.

2.3 Tracking in Danish upper secondary education

The Danish educational system consists of nine years of compulsory schooling (typically from age 6-16) followed by optional secondary (age 16-19) and higher education (age 19+). There is no tracking in compulsory school, and students usually stay in the same class from grade 1 through grade 9.[1] Upon completion of compulsory school tracking, students have to choose between three educational options: Leave school, enter vocational education, or enter upper secondary education.

Vocational education usually takes 3-4 years during which the student alternates between school-based training and working as an apprentice with an employer. Vocational training does not provide eligibility for higher education, for example at university, and in most cases students enter the labor market in a skilled job having completed their vocational education. Consequently, in most cases vocational education does not lead to any further education.

Upper secondary education normally takes three years and is the academically oriented track in Danish secondary education (it is similar to high school in the US, Gymnasium in Germany, and A-levels in the UK). The purpose of upper secondary education

[1] Denmark used to track students in the fifth and seventh grade (like in Germany). However, tracking in compulsory school was abolished in two reforms in 1958 and 1975.

is to prepare students for higher education. There are two main routes in upper secondary education: the traditional academic track (*gymnasium*) and two vocationally oriented tracks (a *mercantile* and a *technical* track).[2] The two vocationally oriented tracks, introduced in the 1970s and 1980s, offer practically oriented curricula (specializing in, for example, business economics or technical subjects). The academic track, by contrast, offers traditional *Bildung*-type subjects such as classical studies, visual arts, and science. Today, around one-third of those who enter upper secondary education enroll in one of the two vocationally oriented tracks.

Having successfully completed either the academic track or one of the vocationally oriented tracks provides eligibility for higher education. In Denmark, the different types of higher education are classified as lower tertiary education (1-2 years, for example lower-level technician), university college (3-4 years, for example nurse and school teacher), and university (5-6 years, for example medical doctor and civil engineer).

3. Data

We use data from Danish administrative registers that cover the entire student population that completed compulsory school in the years 2002 and 2003. Because the registers are updated on an annual basis, we can follow each student's pathway through the educational system up to the year 2010. The registers also provide information on the student's Grade Point Average (GPA) at the end of compulsory school and, if applicable, GPA at the end of upper secondary education. We restrict the analysis to the 2002/2003 cohorts because information on GPA

[2] Danish upper secondary education also includes a "late starter" track which is similar to the General Educational Development (GED) in the US. We ignore this track in the present analysis because, first, our data do not allow us to include this group in a satisfactory way and, second, only a minor proportion of students choose this option.

after compulsory school is not available for earlier cohorts. Through the registers we can link students to their parents, enabling us to include information on socioeconomic background.

3.1. Dependent variables: Educational transitions

We follow students seven to eight years after they completed compulsory school. We restrict the sample in three regards. First, we omit students who choose the "late starter" track in upper secondary education (approximately 6.6 percent of the total population). We omit these students because they typically start secondary education later than others and, as a consequence, our time window is too short to capture their entire educational career. Second, because our time window is comparatively short, we study enrollment in, but not completion of, higher education (any type of higher education, i.e., lower tertiary education, university-college, or university). Third, we merge the mercantile and technical tracks in upper secondary education into one track labeled *vocational upper secondary education* (which is the common classification used for both tracks by public authorities). Finally, we also merge the different types of higher education (short tertiary, university college, and university) into one group labeled *higher education*.

Our analysis sample includes 66,232 respondents (evenly distributed in the two cohorts, 2002 and 2003). Because of missing information on around 20 percent of the sample (on the variables included in the analysis), our analysis sample does not cover the entire population. However, the distributions of secondary and higher education in the analysis sample match very closely that of the total population.

Table 1 shows descriptive statistics for all variables used in the analysis. We study two educational transitions: (1) the transition from compulsory school to secondary education and (2) the transition from upper secondary education (vocational or academic) to

higher education. With regard to the first transition, Table 1 shows that 20 percent of the sample does not complete any type of secondary education after leaving compulsory school, 24 percent completes vocational education and the remaining 56 percent completes (either vocational or academic) upper secondary education. With regard to the second transition, Table 1 shows that among those who complete upper secondary education 81 percent enroll in some type of higher education. The table also breaks down higher education into two categories: lower tertiary education/university college and university. Among those completing upper secondary education, 63 percent enroll in lower tertiary education or university college, while 18 percent enroll in a university program.

– TABLE 1 HERE –

3.2. Explanatory variables

We include explanatory variables pertaining to students and to their families. For students, we include (1) a dummy variable for women, (2) dummy variables for birth cohort (1984-1988), and (3) two variables measuring GPA in respectively compulsory school and in upper secondary education (labeled GPA_{COMP} and GPA_{UPSEC} in Table 1). The Danish GPA scale is a seven-point scale ranging from -3 to 12, with 12 being the highest grade[3]. To capture social background, we include measures of:

1. Parents' highest socioeconomic status (SES) measured by the international socioeconomic index (HISEI) (Ganzeboom, De Graaf, and Treiman 1992; Ganzeboom and Treiman 1996).
2. Parents' highest educational attainment measured by the ISCED scale (UNESCO 1997).

[3] The seven grade values are -3, 0, 2, 4, 7, 10 and 12 where -3 is the worst and 12 is the best possible grade.

3. A dummy variable indicating whether the student's parents were married in the year prior to completing compulsory school.
4. Family size (total number of children in the family) at age 15.
5. Country of origin (we distinguish between Denmark, other developed country, and developing country).

In addition to these explanatory variables, we also include two variables to improve identification of our statistical model. These variables measure the travel distance in kilometers from the student's home to (1) the nearest vocational upper secondary school and (2) the nearest academic upper secondary school. The idea behind using these variables, which is explained in more detail in the methods section below, is that the distance to the nearest academic or vocational secondary education institution may affect students' decision about whether or not to enroll in this type of institution. For example, some students live in rural areas in which there is a considerable distance to the nearest academic or vocational upper secondary education institution. By contrast, some students live in bigger cities in which there is a large supply of educational institutions. As a consequence, the distance to the nearest (academic or vocational) upper secondary education institution is likely to affect the student's choice of secondary education.

4. Methods

4.1 Statistical model

Our statistical model is intended to capture two educational transitions: the transition from compulsory school to secondary education (with the options: leave school, vocational education, vocational upper secondary education, and academic upper secondary education)

and, for those who complete either vocational or academic upper secondary education, the transition into higher education. We use a multinomial transition framework similar to that proposed by Breen and Jonsson (2000) and Karlson (2011). In our model, the likelihood that the student makes each educational transition is assumed to depend on observed and unobserved variables. We control for the influence of unobserved variables to address selection into the different educational tracks based on individual and socioeconomic background characteristics that are not observed in our data.

Let Y_1 denote the outcome of the first educational transition with domain $y_1 \in \{0,1,2,3\}$, where 0 denotes leaving the educational system after compulsory school, 1 denotes choosing vocational education, 2 denotes choosing vocational upper secondary education, and 3 denotes choosing academic upper secondary education. Let Y_2 denote the outcome of the second transition with domain $y_2 \in \{0,1\}$, where 0 denotes leaving the educational system after either vocational or academic upper secondary education and 1 denotes continuing in higher education. We write the joint probability of the sequential outcomes of Y_1 and Y_2 conditional on observed and unobserved explanatory variables

$$\begin{aligned} &\Pr(Y_2 = y_2 \mid x_2, z, Y_1 \geq 2) \cdot \Pr(Y_1 = y_1 \mid x_1, z) = \\ &\sum_{w=1}^{W} \Pr(Y_2 = y_2 \mid x_2, z, Y_1 \geq 2, \mathbf{v}_{1w}) \cdot \Pr(Y_1 = y_1 \mid x_1, z, v_{2w}) \cdot \pi_w \end{aligned} \qquad (1)$$

In Equation (1) z refer to explanatory variables that are common to both educational transitions (student's sex, birth cohort, and the socioeconomic background variables) and x_1, and x_2 refers to explanatory variables that vary across the two transitions (GPA and the two variables measuring distance to upper secondary educational institutions).

In addition to observed explanatory variables, $\mathbf{v}_{1w} = \{v_{11w}, v_{12w}, v_{13w}\}$ and v_{2w} refers to unobserved variables (for example, IQ and motivation) which affect the likelihood that the student makes each of the two transitions. $\mathbf{v}_{1w}$ refers to a vector of unobserved variables that affect the transitions from compulsory school to upper secondary education (one variable for each type of upper secondary education) and v_{2w} refers to unobserved variables affecting the transition from upper secondary education to tertiary education. The error terms are allowed to be correlated across tracks and transitions. Following Breen and Jonsson (2000) and Karlson (2011), we use a finite mixture approach and capture the effect of the unobserved variables on educational decisions through a number of latent classes. The idea in this approach is that we approximate the distribution of the unobserved variables by hypothesizing that students belong to one of several latent groups that differ with regard to their probability of making each of the two educational transitions. In our analysis we have *w = 1,2,3*[4] classes, where π_w in Equation (1) refers to the probability that the student belongs to latent class *w*. Below, we discuss identification of the latent classes.

We parameterize Equation (1) as a logit model, which means that we treat the first educational transition as a multinomial logit model and the second transition as a binary logit model. We then write Equation (1) as:

$$\sum_{w=1}^{W} \frac{\prod_{j=1}^{j=4} \exp(\boldsymbol{\beta}_{1j}' \mathbf{x}_1 + \boldsymbol{\gamma}_{1j}' \mathbf{z} + \nu_{1jw})^{1(Y_1=j)}}{1 + \sum_{j=2}^{j=3} \exp(\boldsymbol{\beta}_{1j}' \mathbf{x}_1 + \boldsymbol{\gamma}_{1j}' \mathbf{z} + \nu_{1jw})} \times \left(\frac{\exp(\alpha \cdot 1(Y_1 = 2) + \boldsymbol{\beta}_2' \mathbf{x}_2 + \boldsymbol{\gamma}_2' \mathbf{z} + \nu_{2w})^{1(Y_2=1)}}{1 + \exp(\alpha \cdot 1(Y_1 = 2) + \boldsymbol{\beta}_2' \mathbf{x}_2 + \boldsymbol{\gamma}_2' \mathbf{z} + \nu_{2w})} \right)^{1(Y_1=1)} \times \pi_w, \quad (2)$$

[4] The number of latent classes in the model was determined by gradually increasing the number of class until model fit no longer improves. This method was suggested by Breen and Jonsson (2000) and Holm (2001).

where the variables are the same as before and where $\boldsymbol{\beta}$ and $\boldsymbol{\gamma}$ refer to vectors of regression coefficients to be estimated. The notation *1(.)* signifies is a Boolean operator taking the value one if the expression in the parenthesis is true and zero otherwise. The parameter α is of central interest because it captures the effect of having attended vocational upper secondary education rather than academic upper secondary education on the likelihood of enrolling in higher education. Thus, α captures the effect of track placement in upper secondary education on the transition to higher education. In relations to our theoretical framework, a negative α means that attending vocational rather than academic upper secondary education reduces the likelihood of continuing in higher education. This effect is consistent with the *diversion hypothesis* stating that the existence of vocationally oriented tracks in upper secondary education leads students away from university. By contrast, if α is zero then attending a vocationally oriented track rather than the academic track has no detrimental effect on the likelihood of continuing in higher education. This effect (potentially combined with less selectivity in the likelihood of choosing vocational upper secondary education over academic upper secondary education) supports the *inclusion hypothesis*.

The model in Equation (2) accounts for selection into the different tracks in secondary education based on observed (x, z) and unobserved ($\boldsymbol{v}_1$,v_2) variables. The parameters are estimated using full information maximum likelihood which entails estimation of all parameters in the model simultaneously. Our model is formally identified from the assumption that it is a logit model. However, in order to improve identification, and in particular identification of the latent classes which capture the effect of the unobserved variables, we also include explanatory variables that vary across educational transitions and several exclusion restrictions (Karlson 2011; Jæger and Holm 2007; Holm 2002; Lucas 2001).

Our variables which vary across educational transitions are the student's GPA after compulsory school (GPA_{COMP}) and after upper secondary education (GPA_{UPSEC}). We furthermore include two variables which act as exclusion restrictions, that is, variables which are assumed to affect the first educational transition but not the second. As explained previously, these two variables measure the distance in kilometers from the student's home to respectively the nearest vocational upper secondary school and the nearest academic upper secondary school. Previous studies have used distance to schools as a proxy for commuting time and costs (e.g., Alderman et al. 2001; Schwartz 1985). We argue that the distance to educational institutions affect the student's decision about whether or not to enroll in vocational and academic upper secondary education but, conditional on actually enrolling in one type of upper secondary education, this distance has no effect on the likelihood that the student continues in higher education. In our model, we include the variable capturing the distance to the nearest *vocational* upper secondary school only in the equation for the likelihood of choosing vocational upper secondary education, while the variable capturing the distance to the nearest *academic* upper secondary school is only included in the equation for this educational outcome. Below, we present empirical evidence on the validity of the exclusion restrictions.

4.2. Counterfactual simulations

We use the results from our empirical analysis to calculate counterfactual distributions of educational decisions assuming that vocational upper secondary education did not exist. Counterfactual analysis is useful for understanding the consequences of tracking for educational inequality. Based on our model, we estimate which educational decisions students who did choose vocational upper secondary education would have chosen had the vocational

track not existed. Furthermore, we analyze the implications of counterfactual educational decisions on enrollment patterns in higher education. We ask whether students who chose vocational upper secondary education would have been better off choosing academic upper secondary education with regard to their likelihood of enrolling in higher education and, furthermore, whether they would have chosen different levels of higher education (lower tertiary, university college, and university).

We need to make several assumptions in order to calculate counterfactual distributions of educational decisions. First, we need to assume that our statistical model accounts adequately for the factors (socioeconomic background, academic ability, etc.) that predict educational decisions. Naturally, we do not observe all the relevant factors that affect educational decisions, but our model also takes unobserved factors into account. Second, we need to assume that we can recover students' ranking of the attractiveness of different options in Danish secondary education. In order to recover these rankings, we interpret our model as a random utility model in which educational choices are outcomes of utility-maximizing decisions (e.g., Henscher and Greene 2003; McFadden 1974). In this interpretation, and given the empirical estimates from our statistical model, we can calculate which educational option is the second most attractive one for students who did choose vocational upper secondary education. The second most attractive option is defined as the one which students, given their observable and unobservable characteristics, have the highest predicted probability of choosing.[5] Consequently, based on these assumptions and on the results from our empirical analysis, we can calculate which (counterfactual) educational choice students would have

[5] Calculating predicted probabilities conditional on observed characteristics is straightforward. With regard to unobserved characteristics, we follow convention and estimate predicted probabilities with respect to the prior distribution of the latent classes (Rabe-Hesketh et al. 2004).

made had vocational upper secondary education not existed. Finally, in order to analyze whether vocational upper secondary education reinforces, is neutral to, or reduces socioeconomic inequalities in higher education enrollment, we calculate counterfactual distributions of higher education choices for students with different socioeconomic backgrounds.

4. Results

The results section is divided into two parts. In the first part we analyze observed and unobserved determinants of educational choices, with a particular focus on (1) the role of socioeconomic background and (2) the effect of choosing vocational upper secondary educational over academic upper secondary education on the likelihood of enrolling in higher education. In the second part we present results from counterfactual analyses in which we assess the implications at the population level of hypothetically closing down vocational upper secondary education.

4.1. Social selection into upper secondary education

Table 2 shows results from our statistical model of educational transitions. The first transition concerns the choice of secondary education (in which we use the category "leave school" as the reference category), while the second transition concerns whether or not respondents enroll in higher education.

Our results for the first educational transitions reveal expected socioeconomic gradients in educational decisions. Compared to respondents from disadvantaged socioeconomic backgrounds, respondents whose parents have higher socioeconomic status and more education are more likely to choose vocational upper secondary education or

academic upper secondary education over no education. This pattern also exists for respondents who grew up in intact families, who have fewer siblings and who had a higher GPA at the end compulsory school. As reported in previous research, socioeconomic gradients are small when comparing students who choose vocational education over no education. Moreover, supplementary analysis using vocational upper secondary education as the reference group shows that respondents who chose academic upper secondary education over vocational upper secondary education tend to come from more privileged socioeconomic backgrounds. Consequently, when comparing the socioeconomic composition of students within upper secondary education, those in the academic track comprise a particularly select socioeconomic group.

Table 2 also shows that the two variables included as exclusion restrictions have the expected effects. The distance from the respondent's home to the nearest vocational upper secondary education school has a negative effect on the likelihood of choosing this educational option over no education. The same result applies to the effect of the distance to the nearest academic upper secondary education school on the likelihood of choosing this educational option. Finally we also note that GPA is a powerfull predictor of choice of track and enrolment into higher education.

– TABLE 2 HERE –

4.2 The effect of tracking in upper secondary education

Having established considerable socioeconomic selectivity with regard to choice of track in secondary education, we now turn to the results for the second transition into higher education. Table 2 shows that, among respondents who completed either vocational or

academic upper secondary education, socioeconomic background continues to exert a considerable impact on the likelihood of continuing in higher education. Thus, respondents whose parents have higher socioeconomic status and more education are more likely to continue in higher education compared to those from less privileged backgrounds. In addition to socioeconomic gradients at the second educational transition, our main interest is to estimate the difference in the likelihood of enrolling in higher education for students who completed respectively the vocational and the academic track in upper secondary education. We hypothesized that the vocational track in upper secondary education may either *divert* or *include* students from higher education. The vocational track diverts students if, holding other factors constant, the likelihood of continuing in higher education is lower for students who completed this track compared to students who completed the traditional academic track. The vocational track includes students if, taking the less selective socioeconomic composition of the group of students who choose this option into account, there is no difference in the likelihood of continuing in higher education.

Table 2 shows a highly significant negative effect of having completed the vocational track rather than the academic track on the likelihood of continuing in higher education. The estimated log-odds ratio between the vocational track and the academic track is -1.581, which is roughly one and half times the magnitude of the effect of the highest versus the lowest category of parental education. We calculate the average partial effect (APE) of having completed vocational upper secondary education rather than academic upper secondary education on the likelihood of continuing in higher education. The APE is the difference in the predicted probability of enrolling in higher education for respondents who completed the vocational rather than the academic track, calculated for each respondent and averaged over the entire sample (and holding all other factors constant). The estimated APE is

-14.9 percentage points, which suggests that respondents who complete vocational secondary education rather than upper secondary education are around 15 percentage points less likely to continue in higher education. We interpret this negative effect as substantively large and as indicative of a considerable diversion effect. Below, we use counterfactual simulations to study the implications of this diversion effect for socioeconomic inequality in educational outcomes.

4.3. Inclusion or diversion?

Our empirical results point to an interesting paradox. On the one hand, vocational secondary education is more inclusive than academic upper secondary education because it attracts students from less advantaged socioeconomic backgrounds. In this capacity, the vocationally oriented track reduces educational inequality by increasing access to upper secondary level qualification. On the other hand, choosing the vocationally rather than the academically oriented track in upper secondary education (and holding all other observable and unobservable factors constant) has a significant negative effect on the likelihood of later enrolling in higher education. Using a ladder as a metaphor, our results thus suggest that vocational upper secondary education makes disadvantaged students more likely to take the first step on the educational ladder (and obtain upper secondary level credentials) but, at the same time, it also makes them less likely to take the second step into higher education.

We now present results from counterfactual simulations of distributions of educational outcomes. The aim of this analysis is to gauge the consequences of educational tracking in upper secondary education at the population level. We simulate, first, secondary education choices for students who chose vocational upper secondary education *had this*

alternative not existed and, second, differences in counterfactual educational outcomes for students with different socioeconomic backgrounds. Table 3 summarizes results.

– TABLE 3 HERE –

The top panel in Table 3 compares the simulated distribution of secondary education choices (assuming that vocational upper secondary education did not exist) with the actual distribution. The table shows that, had the vocational track in upper secondary education not existed, then a substantively lower proportion of students (around six percentage points) would have attended academic upper secondary education and would instead have attended vocational education. Consequently, our simulations suggest that vocational upper secondary education provides access to higher education for students who would not otherwise have enrolled in academic upper secondary education.[6]

The middle panel in Table 3 breaks down the simulated and actual proportions of students who acquire upper secondary education credentials (vocational or academic) by parents' socioeconomic status (SES). These simulations show that, assuming that vocational upper secondary education did not exist, low-SES students would be more disadvantaged than

[6] We think of this effect as mainly pertaining to students on the margin of enrolling in an upper secondary education program. For example, assume that a student comes from a skilled working class family and has good academic ability. This student may consider becoming an electrician (vocational education) or an electrical engineer (a four year program at a university college which requires upper secondary level qualifications for admission). The existence of a vocational track in upper secondary education makes it easier for this student to envision becoming an electrical engineer given the technically oriented curriculum in this track. However, had the vocationally oriented track not existed, this student would have had to go through academic track in order to qualify for electrical engineering and might have had a lower likelihood of completing this track.

high-SES students with regard to acquiring upper secondary education qualifications. Among students whose parents belong to the first SES quartile, three percentage points fewer students (23.9 versus 26.9) would have acquired upper secondary level qualifications had the vocationally oriented track not existed. This difference becomes smaller as we move up in the distribution of parental SES, and among students from the fourth quartile we find that a slightly higher proportion (0.4 percentage points) would acquire upper secondary education credentials had the vocational track not existed. The reason for the latter results is that, among high-SES students who have a high probability of enrolling in the academic track in upper secondary education, the existence of the vocationally oriented track diverts a few of these students away from the academic track. However, our overall conclusion is that the existence of vocational upper secondary education mainly benefits students from low-SES families and, as a consequence, reduces socioeconomic inequality in access to upper secondary education.

Our final analysis pertains to simulated and actual enrollment patterns in higher education. We have found that the vocationally oriented track in upper secondary education leads to more low-SES students acquiring the qualifications needed to continue in higher education. However, despite leading to more students obtaining upper secondary education qualifications, we have also found that completing the vocationally oriented track rather than the academic track is associated with a significantly lower probability of subsequently enrolling in higher education. Incorporating this penalty into our analysis, the lower panel in Table 3 shows the differences in simulated and actual enrollment patterns in higher education by parental SES. Distinguishing between short tertiary education/university college on the one hand and university on the other, this panel shows what the differences in enrollment rates would have been had the vocational track in upper secondary education not existed. The main result is that, for those who continue in higher education, vocational upper secondary

education leads more students from low-SES families to enroll in short tertiary and university college educations, but not in university education. Students whose parents belong to first SES quartile would have been 2.8 percentage points less likely to enroll in short tertiary education or university college, had the vocationally track in upper secondary education not existed, but only 0.2 percent less likely to enroll at university. This pattern, although weaker, also exists for students whose parents belong to the second and third SES quartiles, and it suggests that the socially inclusive effect of vocational upper secondary education operates mainly at the lower levels of higher education. This result is consistent with the EMI hypothesis by Lucas (2001) which suggests that when low-SES students gain access to the same levels of (upper secondary) education as high-SES students, then high-SES families respond by concentrating in "high-quality" education at the next level (university versus short tertiary education/university college).

6. Discussion

This paper studied the effect of tracking in secondary education on enrollment in higher education. It used Denmark as the institutional context because this country has strong tracking in secondary education and because the choice of educational track has largely irreversible consequences for students' later educational careers. The paper also sought to distinguish empirically the effect of selection into different tracks based on socioeconomic background from the effect of track placement on enrollment in higher education and furthermore to gauge the implications of tracking for overall educational inequality.

We report three main results, which speak directly to previous research on educational tracking. First, even in the equality-oriented Danish context we find strong evidence of socioeconomic gradients in track placement in upper secondary education. We

do, however, find that the vocationally oriented tracks are less socially selective than the academic track. Second, we find that completing vocational upper secondary education rather than academic upper secondary education has a significant negative effect on the likelihood of pursuing higher education. Holding other factors constant, enrollment rates in higher education are on average 15 percentage points lower among students who attended the vocationally oriented tracks in upper secondary education compared to those who attended the academic track. Third, we find that the vocationally oriented tracks in upper secondary education have a socially inclusive effect on educational inequality at the population level. Using counterfactual simulations, we find that the vocationally oriented tracks include students in higher education who would otherwise not have attended higher education, and furthermore that this inclusion effect is particularly salient among students from disadvantaged socioeconomic backgrounds. We also find that the inclusive effect of vocational upper secondary education is mostly limited to the likelihood of attending less-prestigious levels of higher education (lower tertiary and university college) and not university.

Our findings point to an interesting paradox relevant to research on educational tracking. While the vocationally oriented tracks in upper secondary education are more socially inclusive than their academic counterpart, they reduce the likelihood of continuing in higher education. Consequently, they only partially succeed in reducing socioeconomic inequalities in educational outcomes. This result may be related to three aspects of upper secondary education in Denmark. First, the curricular differences between the two tracks. The curriculum in academic upper secondary education is traditionally compatible with that offered at university, while the technical and practical curriculum in vocational upper secondary education is more compatible with that offered in short tertiary education and

university college. Second, differences in the socioeconomic composition of peers, along with friendship formation and peer influences, may lead to an alignment of educational expectations within tracks (Hallinan and Sørensen 1985; Southworth and Mickelson 2007). Third, track placement in upper secondary education may send signals to students about their academic potential, which in turn affects their educational aspirations (Vanfossen et al. 1987) and self-esteem (Van Houtte et al. 2012).

Our main findings may also extend to other contexts. For example, our finding that the existence of less academically oriented tracks in upper secondary education have socially equalizing effects but are associated with less favorable outcomes in higher education might also apply to the US. Here, previous research has documented effects of tracking in secondary education on academic achievement, but, to our knowledge, no research has analyzed the effect of tracking on the likelihood of attending two-year versus four-year college. This type of effect might be considered as an extension of the EMI hypothesis.

Lastly, the results we report in this paper should be interpreted within the particular context of the organizational differentiation of secondary education into lower and upper programs and, within the upper programs, a differentiation of vocationally and academically oriented programs in Denmark. In educational systems with a different degree differentiation, the consequences of tracking might be different [see, e.g., Ichou and Vallet (2011) for France or Hall (2012) for Sweden]. Furthermore, educational tracking in Denmark happens somewhat late in the student's life (around age 16), and the consequences of tracking we report might reflect this institutional feature. In other countries which track students early, the effects could be different. To answer these questions, using the methodology we develop in this paper might prove valuable. Given their generality, our transition model and simulation methodology can easily be accommodated to almost any educational system. Applying our

methods to other countries will moreover allow stratification researchers to assess whether characteristics of educational systems (e.g., early tracking or availability of secondary education programs) correlate with the equalizing effects of tracking on future educational outcomes.

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TABLE 1 Descriptive statistics for analysis sample. Means (fractions) and standard deviations

	Mean/Percent	SD
First transition: Secondary Education:		
Leave	0.20	
Vocational	0.24	
Vocational upper secondary education	0.18	
Academic upper secondary education	0.38	
Second transition: Higher Education[a]		
Not enrolled	0.19	
Enrolled	0.81	
Short tertiary/University college	0.63	
University	0.18	
Female (ref. Male)	0.48	
GPA_{COMP}	6.38	1.92
GPA_{UPSEC}[a]	6.31	1.96
Parents' socioeconomic status	53.05	16.86
Parents' education		
2: Compulsory education (9-10 years)	0.07	
3A: Upper secondary (academic, vocational)	0.01	
3C: Lower secondary (vocational)	0.49	
5B: Short/Medium cycle tertiary	0.30	
5AC: Long cycle tertiary (university)	0.12	
6: PhD, M.D.	0.01	
Intact family (ref. non-intact family)	0.73	
Family size	2.83	1.13
Country of origin		
Denmark (reference)	0.97	
Other developed country	0.01	
Developing country	0.02	
Birth cohort		
1985	0.04	
1986	0.48	
1987	0.46	
1988	0.02	
Travel distance from home to nearest vocational upper secondary school (in kilometers) [b,c]	10.92	8.06
Travel distance from home to nearest academic upper secondary school (in kilometers) [b]	7.56	6.80

Note: [a] Includes students who have completed upper secondary education only, [b] Geodistance measure obtained from Statistics Denmark, [c] Distance for this track is the average travel distance to nearest upper secondary trade school or technical school.

TABLE 2 Results from the mixed multinomial educational transition model. Log odds-ratios with standard errors in parentheses. Reference group for secondary education choice is leaving school after compulsory school. All estimates adjusted for birth cohort

	Secondary Education			Higher Education
	Vocational Education	Vocational Upper Sec.	Academic Upper Sec.	Enrolment
Vocational upper secondary (ref. Academic upper secondary)	-	-	-	-1.518*** (0.076)
Parents' socioeconomic status	0.00002 (0.001)	0.016*** (0.002)	0.025*** (0.002)	0.005** (0.002)
Parents' education (ref. 2)				
3A	-0.197 (0.188)	0.796*** (0.217)	1.176*** (0.216)	-0.080 (0.197)
3C	0.617*** (0.074)	1.016*** (0.098)	0.935*** (0.101)	0.110 (0.126)
5B	0.281*** (0.081)	1.007*** (0.108)	1.673*** (0.111)	0.643*** (0.130)
5AC	-0.370** (0.128)	0.640*** (0.154)	2.142*** (0.155)	1.050*** (0.144)
6	-0.196 (0.462)	0.874 (0.479)	2.644*** (0.470)	0.973*** (0.246)
GPA[a]	0.534*** (0.010)	1.758*** (0.059)	2.287*** (0.020)	0.510*** (0.020)
Female (ref. Male)	-0.506*** (0.041)	-0.441*** (0.058)	0.336*** (0.057)	0.330*** (0.046)
Country of origin (ref. Denmark)				
Other developed country	-0.757** (0.250)	0.194 (0.302)	1.070*** (0.296)	1.269*** (0.272)
Developing country	-1.128*** (0.153)	0.418* (0.191)	1.351*** (0.189)	1.570*** (0.201)
Intact family (ref. Nonintact family)	0.971*** (0.064)	1.261*** (0.071)	1.172*** (0.068)	0.110* (0.052)
Family size	-0.069*** (0.018)	-0.144*** (0.022)	-0.119*** (0.022)	0.052** (0.020)
Distance from home to nearest upper secondary track[b]	-	-0.016*** (0.002)	-0.016*** (0.002)	-
Intercept	0.322** (0.121)	-0.958*** (0.167)	-1.893*** (0.168)	2.693*** (0.229)
Minus 2 Log-likelihood	158,611.9			

Note: *$p < 0.05$. **$p < 0.01$. *** $p < 0.001$. The model has three latent classes. Estimates for latent classes shares and effects are available upon request.
N = 66,232 (first transition into secondary education) and 37,373 (second transition into higher education decision).
[a] Refers to GPA_{COMP} in first transition and to GPA_{UPSEC} in second transition, [b] Effect of alternative-specific distance measures constrained in a conditional logit setup for identification purposes.

TABLE 3 Results from counterfactual analyses

	Simulated and actual distribution of secondary education choices		
	Simulated	Actual	Difference
Exit	20.5	19.7	0.8
Vocational	29.0	23.9	5.1
Academic upper secondary	50.5	56.3	-5.9
Total	100.0	100.0	0.0
	Simulated and actual distributions of secondary education choices by parents' socioeconomic status		
	Simulated	Actual	Difference
Parents' socioeconomic status:			
1st quartile	23.9	26.9	-3.0
2nd quartile	35.1	37.3	-2.2
3rd quartile	56.1	56.4	-0.3
4th quartile	71.3	70.8	0.4
Population	44.2	45.5	-1.3
	Differences in simulated and actual distributions of higher education choices by parents' socioeconomic status		
	Short tertiary/ University college	University	Total
Parents' socioeconomic status:			
1st quartile	-2.8	-0.2	-3.0
2nd quartile	-2.0	-0.2	-2.2
3rd quartile	-0.8	0.5	-0.3
4th quartile	-0.6	1.0	0.4
Population	-1.7	0.4	-1.3

Note: Due to rounding, in some cases percentages do not add up to 100 percent.