



Better close to home? Geographical and socioeconomic constraints on gendered educational transitions at the upper secondary level

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ARTICLE INFO

Keywords:

Geographical distance
Upper secondary education
Educational track
Field of study
Social origin
Gender

ABSTRACT

Educational decisions are affected by geographical accessibility, which may have far-reaching consequences for young people's future educational pathways. In this paper, we examine the extent to which geographical distance to educational institutions may moderate young people's applications to upper secondary education in terms of both the track and the gender-(a)typicality of vocational fields of study they apply to. Our study relies on rich register-based data of complete cohorts of 16-year-olds applying to Finnish upper secondary institutions, linked with geographical information on their closest educational alternatives. We find that travel time to the academic track is more decisive than the distance to vocational schools, with geographical accessibility being more significant for boys' rather than for girls' application patterns. Moreover, distance sensitivity varied by social origin, with daughters of low-educated parents and sons of medium-educated parents particularly likely to adjust their upper secondary application to the geographical accessibility of educational alternatives. However, we find some indications that particularly girls from lower-educated social backgrounds are more prepared to consider fields of study not typical for their gender if they are more geographically accessible than key alternatives. No such gender-atypical substitutions were evident among boys. We discuss the implications of these findings in the context of explanatory approaches based on risk aversion and (gender) socialization.

1. Introduction

Educational inequality has distinct geographical dimensions. Young people living at a longer geographical distance from higher education institutions have been found to participate less often in tertiary education (Finger, 2016; Frenette, 2006; Sá et al., 2006; Spiess & Wrohlich, 2010; Turley, 2009). Some studies have found distance to induce a shift among entrants towards more geographically accessible institutions rather than to affect tertiary enrolment rates as such (Flannery & Cullinan, 2014; Gibbons & Vignoles, 2012; Knutsen et al., 2020). Similarly, the distance to education seems to play some role in students' field of study choice (Hango et al., 2019; Suhonen, 2014).

While geographical accessibility may not on its own guarantee equal educational opportunities, existing evidence suggests that travel distances are relevant for educational decisions, particularly among young people from lower socioeconomic backgrounds (Denzler & Wolter, 2011; Gibbons & Vignoles, 2012; Hällsten, 2010; Pignini & Staffolani,

2016). If geographical accessibility affects young adults' educational pathways, longer travel times likely pose even greater constraints, understood in terms of social, psychological and financial costs, on even younger students, such as adolescents considering their educational options. Particularly in tracked educational systems, geographical inequality at the point of upper secondary transitions may thus have far-reaching repercussions on young people's future pathways. With a handful of exceptions (Bertrand-Cloodt et al., 2010; Dickerson & McIntosh, 2013; Falch et al., 2013; Virtanen & Riukula, 2021), upper secondary education has been fairly neglected by (quantitative) sociological inquiries into the geographical dimensions of educational inequality.

In this study, we analyse vertical and horizontal dimensions of upper secondary transitions in Finland by combining information on educational applications and geographical distance to educational institutions. In Finland, the choice between the academic and vocational tracks is the first turning point with "vertical" implications regarding

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<https://doi.org/10.1016/j.rssm.2023.100879>

Received 22 March 2023; Received in revised form 30 October 2023; Accepted 12 December 2023

Available online 21 December 2023

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educational attainment. This is because the curriculum of high schools is primarily designed to prepare students for subsequent academic studies at higher education institutions, whereas vocational schools provide fairly occupation-specific qualifications with more immediate labour market relevance after graduation (Finnish National Agency for Education, 2023). Although both educational tracks provide formal eligibility to apply to higher education, the academic track (i.e., high schools) represents a more likely pathway towards tertiary enrolment.¹ Geographical constraints at this first significant educational transition may thus not only constitute an incidence of educational inequality in its own right, but significantly exacerbate existing social origin differences in educational outcomes.

Upper secondary transitions are not only relevant to intergenerational social mobility or reproduction processes, but they also are highly gendered. Higher education qualifications in Finland are significantly more common among women than men (Statistics Finland, 2018). This gender difference in average educational attainment is partly rooted in the fact that girls are now overrepresented on the academic track, whereas boys constitute the majority among students in vocational upper secondary education. In addition, field specializations within the vocational sector are strongly gender-segregated. As such, upper secondary education constitutes a complex junction where social reproduction and mobility processes combine with gender dynamics.

Our aim in this paper is to examine how geographical constraints may interact with both social inequality and gender segregation processes in shaping adolescents' educational aspirations in Finland. In doing so, we offer both empirical and theoretical contributions. Firstly, as pointed out above, aspects of geographical accessibility constitute a neglected angle in social research on educational opportunity, particularly regarding to upper secondary education. Secondly, our analyses of geographical constraints open up a new perspective on the interaction between social origins and gender segregation processes in education (Prix & Kilpi-Jakonen, 2022; Seehuus, 2019). Especially when geographically better accessible options are less desirable regarding their social mobility prospects and the degree to which they would conform or oppose gender normative expectations, distance to education may aggravate tensions for young people between aspired and feasible educational pathways.

In summary, these aims lead us to the following two research questions:

1. To what extent does geographical distance matter for adolescents' decisions between the vocational and the academic track on their upper secondary applications, and how does its relevance vary by social origin?
2. In what way does the relative proximity of educational alternatives lead to shifts in preferred tracks and fields of study, particularly regarding gender-(a)typical substitutions, and how do such substitutions vary by social origin?

We examine these questions using rich register-based data on educational applications of complete cohorts of 16-year-old girls and boys applying to the Finnish upper secondary sector between 2009 and 2013. The fact that we focus on young people's educational applications rather than their enrolment constitutes a third aspect of our contribution in this article. As we will elaborate below, explanatory accounts of social origin differentials in education typically draw on mechanisms that rely on young people actively choosing or forgoing hierarchically valued types of education. However, most empirical applications associated with this literature are based on individuals' enrolment or graduation patterns, which in Finland (as in many other educational systems) are

¹ In this article, the term "high schools" denotes the academic track of upper secondary education. We use both the terms "academic track" and "high schools" interchangeably throughout the manuscript.

not only contingent on personal choice, but depend also on (often competitive) admission procedures. Moreover, young people's initial educational interests may be more diverse than the programme of their eventual enrolment or graduation may suggest. In this article, we therefore focus on educational applications rather than enrolment patterns, as it allows us to observe a variety of educational alternatives that young people considered after completing compulsory schooling (as their first and next-best choice) before any institutional selection processes further limit their options. Our aim to consider substitution patterns, however, poses also some methodological challenges, which we tackle in this article by introducing mother logit models to the sociological research context.

2. Background and hypotheses

2.1. Why and how should geographical distance matter for upper secondary track choices?

Financially speaking, longer distances to education typically involve higher travel costs. If commuting is not feasible, young people may have to move out of the parental home into student accommodation closer to the school.² This raises expenses due to relocation costs, rent and maintaining a separate household. At the same time, the time spent commuting or living away from local friends and family may lead to also significant emotional costs. Qualitative research has highlighted that young people in rural and sparsely populated areas are often strongly attached to their local environment, with social ties centring significantly on family and (often locally residing) relatives (Rönnlund, 2020; Tuuva-Hongisto et al., 2016). As such, longer distances may weaken social ties to adolescents' local community and increase pressures to become independent at an early age. For students enrolled in education far from home, these overall costs of distance may accumulate over time, which may explain the greater risk of drop-out observed among adolescents studying further away from home (Falch et al., 2013; Virtanen & Riukula, 2021). Although perceptions of distance may vary depending on local contexts, infrastructure, and reference points (Pulkkinen & Rautopuro, 2018, p. 19), previous research suggests that on average, young people prefer educational alternatives in relative proximity over such located further away (Dickerson & McIntosh, 2013; Gibbons & Vignoles, 2012; Knutsen et al., 2020). Based on these considerations and prior findings, we expect the following:

Expectation 1: On average, the longer the distance between applicants' home and either upper secondary track, the lower the probability that the applicant ranks this track as their first choice.

At the same time, it is plausible that gender may play a role in how sensitive young people are to the geographical distance of education, given the significant differences between men's and women's average educational pathways observed in Finland and elsewhere. Some scholars have argued that educational opportunities and occupational domains linked to female-dominated public sector and service occupations tend to cluster in urbanized regions, while male-dominated domains are better represented also in rural areas (Bock, 2017). Realizing (gender-normative) educational and occupational aspirations may thus require on average greater compromises regarding their geographical location from young women compared to young men (Armila et al., 2018;

² In 2019, about 10,000 upper secondary students under the age of 18 lived in student accommodation at least for parts of the academic year (Finnish National Agency for Education, 2020, p. 5). For comparison, this figure represents about 16% of all new upper secondary students in the 16–17 age group during this year (Statistics Finland, 2023b).

Table 1

Driving distances (in minutes) to the nearest upper secondary branches, by track and vocational field (2009–2013).

Upper secondary track	Mean distance	Standard deviation	Lower quartile	Upper quartile
High school	11.0	9.8	4.8	13.8
Vocational school	19.6	18.2	7.8	26.3
Humanities/ Culture	21.7	21.5	9.2	27.2
Business	20.6	18.1	8.9	27.3
Engineering/IT	15.9	14.7	6.5	19.9
Agriculture/ Nature	30.8	20.7	16.4	39.4
Health/Social	19.7	17.8	8.4	26.3
Hospitality	17.7	15.8	7.6	23.1

Faggian et al., 2007).³ A greater tendency to rely on intrinsic work orientations among young women compared to their male peers (Sortheix et al., 2015) may also lower pragmatic attitudes regarding their vocational interests, potentially resulting in a lower weight given to the geographical costs associated with their educational plans. On the other hand, it is also plausible that the general orientation of high schools makes it an attractive option for those applicants fairly undecided about their vocational interests and occupational future (see also Varjo et al., 2020), which for some may also outweigh possible distance costs related to the academic track. Given girls' higher average school achievement and the importance of GPA in the upper secondary admission process, they may have realistic prospects to make use of this delay strategy more often compared to boys.

Prior evidence both supports and contradicts this expectation of distance mattering less for young women than men, suggesting that culture and opportunity structures may affect gender differences in distance sensitivity. A recent study of upper secondary school closures in Finland found boys to react more strongly than girls to the closure of local alternatives (Virtanen & Riikula, 2021), while the reverse gender pattern has been observed in England (Dickerson & McIntosh, 2013). Research focusing on tertiary education has similarly found mixed results, ranging from no noteworthy gender differences (Gibbons & Vignoles, 2012; Suhonen, 2014) to a greater distance sensitivity among young women than men (Frenette, 2006). Despite these mixed previous results, we base our expectations on the substantive considerations above as well as prior Finnish findings on gender differences in the distance to upper secondary education, in the following way:

Expectation 2: Girls are on average less sensitive to the distance of upper secondary institutions than boys when selecting their first-ranked track on their upper secondary application.

2.2. Distance sensitivity and social inequality in education: culture, risk and uncertainty

If distant educational options are considered as psychologically and financially more costly, the accessibility of these pathways will depend on whether applicants are able and willing to afford these costs. As such, spatial dimensions of education are likely to feed into larger social inequality dynamics playing out within the educational system.

Cultural reproduction theory assumes that children from less educated backgrounds forgo academic tracks disproportionately in reaction to their previous experiences in the educational system, which, dominated by cultural elites, is systematically biased against the working class (e.g., Bourdieu & Passeron, 1990). From this perspective, it is not immediately clear that geographical distance or proximity should

³ Although high schools are on average more geographically accessible than vocational programmes, female-typical health and social care fields tend to be located in greater distance than engineering-related vocational programmes in Finland (Table 1).

matter at all. Since the cultural reproduction account assumes alienation from academic tracks as the primary motor for social origin differentials in education, particularly children from less educated backgrounds should be most insensitive to local variations in educational opportunities.

Relative risk aversion approaches, by contrast, assume that families in all social classes share the goal of avoiding social downward mobility for their children, whereas possibilities for upward mobility are only of secondary importance, albeit not irrelevant (Goldthorpe, 2007a). This means that for families in advantaged social positions, educational pathways not clearly associated with higher education destinations may be considered risky regarding this goal of status maintenance. By contrast, for working-class families, academic pathways carry more uncertainty than the more familiar and predictable vocational trajectories. This is because skilled working-class parents may have own experiences of vocational schooling, and therefore more resources and knowledge to support their children throughout vocational education compared to the academic pathways. For them, this should minimize the relative risk of vocational school failure compared to the potential loss of time and resources linked to switching to vocational tracks if the attempt of studying on academic tracks should turn out to be unsuccessful (Goldthorpe, 2007b, 2007a).

Recently, some of the central elements of the risk aversion model have come under closer scrutiny as well as criticism (e.g., Barone et al., 2021; Hällsten, 2017), mainly regarding the assumptions that are implied by the formal representation of the risk aversion model (Breen & Goldthorpe, 1997). In this article, we interpret the risk attached to educational pathways not as (subjective) calculable probabilities of longer-term failure that parents minimize in a sophisticated calculus, but rather as *uncertainty* that is difficult to quantify, to which parents are assumed to respond with fairly simple heuristics in weighing their options (Kozyreva & Hertwig, 2021).

Based on this interpretation of the risk aversion perspective, sensitivity to the geographical distance of upper secondary options is likely to vary across families in different socioeconomic positions. First, we assume that families are least sensitive to the distance of those educational options that represent the most predictable pathway for their children to reproduce their parents' socioeconomic position. In this sense, distance to a status-reproducing type of education may appear less costly, whereas the distance to more unfamiliar options may compound uncertainties about the consequences of possible failure and their longer-term implications. On the other hand, although parents with shorter educational qualifications may be overall more reserved towards the academic pathway, a relative decrease in the distance to academic upper secondary education may make this option (and its upward mobility prospects) slightly less costly, which may also lower uncertainty differentials vis-a-vis the fall-back option of vocational pathways. On the other hand, distance to upper secondary tracks associated with educational downward mobility, such as the vocational option in the case of children with highly educated parents, should not affect their perceived risks. In summary, we expect the following patterns:

Expectation 3. Sensitivity to distance varies by social background and upper secondary track.

- Children from lower- and medium-educated social origins should be more sensitive to the distance of academic education compared to their peers with highly educated parents when applying to upper secondary education.
- For applicants from all social origins, distance to the nearest vocational school should be less relevant than the proximity of academic education when deciding on the first-ranked upper secondary track.

2.3. Compromises between socioeconomic and cultural pressures? Social mobility prospects and gender segregation in upper secondary education

Vocational school branches in Finland often differ in the range of

programmes they offer, which means that the distances to vocational schooling can vary noticeably between different fields of study. This also means that geographical distance may moderate the accessibility of upper secondary education not only regarding educational tracks but also in terms of vocational fields of study, particularly for applicants with lower resources. This raises the question of whether the relative geographical proximity of particular educational options could lead young people to make pragmatic compromises, even if this would imply crossing into gender-atypical fields.

Some educational psychologists have suggested that children's occupational interests develop through a process of excluding unsuitable and inaccessible options, leading to the formation of a gradient of tolerable options rather than a discrete set of expressive preferences. In this account, most children tend to consider occupations through their expressive interests only after first eliminating vocational alternatives deemed unsuitable with respect to their occupational sex type and their social status. As a consequence, this model expects that gender-atypical alternatives will be considered only as a very last resort, with young people more willing to compromise on their expressive interests and the prestige level of their aspired occupation (Gottfredson & Lapan, 1997).

However, scholars have argued that the strength of gender stereotypes mediated via socialization may vary by social origin, assuming more restrictive gender socialization as fostering sex-type conformity, particularly in families with lower resources (Chesters, 2021). Social control theory, on the other hand, has countered that socialization on its own does not suffice to maintain gender-segregated structures, suggesting that compliance with gendered boundaries depends instead on the strength of social sanctions and the opportunities to cross into gender-atypical domains (Jacobs, 1989).

While research on young people's field of study preferences has highlighted the importance of expressive rather than rational motivations (Barone & Assirelli, 2020), the question remains as to which structural constraints and opportunity may lead adolescents to contemplate such pragmatic compromises. A Dutch study of vocational entrants (which was however not restricted to young people nor differentiated by social origin) found geographical distance to more strongly moderate women's rather than men's take-up of (male-dominated) engineering courses (Bertrand-Cloodt et al., 2010). Recent research has found support for gender-atypical educational pathways to depend on social mobility outlooks, questioning the idea of gender-stereotypical orientations as a defining characteristic of less affluent social origins (Prix & Kilpi-Jakonen, 2022).

Based on the discussion above, we assume that adolescents do not easily consider sex type compromises in their vocational aspirations (Gottfredson & Lapan, 1997). As a consequence, pragmatic compromises leading to gender-atypical application patterns may be most likely mainly for those young people for whom geographical distance constitutes a significant constraint. By contrast, children from highly educated families, for whom vocational routes are in general less common, may also be less constrained in terms of resources and therefore experience lower pressures to compromise on their (gender normative) interests. Even if they display greater openness towards gender-atypical fields due to variation in socialization patterns, this preference should be less sensitive to distance compared to their peers from socioeconomically least advantaged backgrounds. These considerations lead us to the following expectation:

Expectation 4: Compared to children from other social backgrounds, children of low-educated parents are the most likely to pick a gender-atypical field as their first (or next-ranked) choice on their application if this field is geographically closer than other alternatives.

3. Context: upper secondary education and geographical distances in Finland

For the cohort of adolescents in this paper, compulsory education ended with completing nine grades of comprehensive school. About

85% of compulsory school leavers enter upper secondary right away, with about 95% of the age cohort having enrolled by the time they were 17 years old (Vipunen Education Statistics Finland, 2023). The upper secondary transition constitutes the first branching point in the Finnish educational system, with the academic track (high schools) as the traditional route towards tertiary education and vocational schools offering fairly occupation-specific qualifications facilitating labour market entry into skilled jobs.

Vocational programmes in Finland have nationally standardized curricula. In 2015, around 50 different vocational qualifications were on offer for young people applying to the upper secondary system (Cedefop, 2015). Vocational institutions are mandated by law to cooperate with regional businesses and to offer courses aligning with local labour market demands. Study programmes for smaller and more specialized fields tend to be more geographically scattered, while fields like engineering and healthcare are more widely available. The allocation of places of study of different fields in different parts of the country reflects policy decisions based on both local labour market demand and various regional and educational policy constraints (Stenström & Virolainen, 2014).

Although both the academic and the vocational track grant eligibility to apply to higher education, tertiary transitions are nevertheless rarer for vocational graduates. In 2019, about 1% of vocational graduates continued at university within a year of completing upper secondary education, compared to 30% of high school graduates. Polytechnics, which offer more vocationally oriented bachelor's and master's degrees compared to universities, represent a somewhat more common pathway after obtaining a vocational qualification, although high school graduates are still more likely to enter this sector of higher education than vocational school graduates (Heiskala et al., 2021). In 2019, around 12% of young people with a vocational qualification (compared to 20% of high school graduates) entered polytechnics within a year of completing upper secondary education (Vipunen Education Statistics Finland, 2022).

Admission to upper secondary education in Finland is organized via a centralized admission system. Applicants can select up to five programmes (high schools or specialized vocational programmes), which they must rank in order of their preference. Higher grade point averages (GPA) in the last year of lower secondary education increases chances of admission to both academic and vocational tracks, with the academic track on average requiring a higher GPA than many vocational programmes. The admission system proceeds in the preference order that applicants have indicated on their application form. This rank order is consequential, as once an applicant receives an offer for a study place for a higher-ranked programme, all lower-ranked choices on their application are automatically cancelled. In 2014, about 84% of 16-year-old applicants were admitted to their first choice overall (Vipunen Education Statistics Finland, 2023).⁴

Fields of study are highly gendered in Finland, particularly so at the upper secondary level (Statistics Finland, 2018, pp. 30–31). Female students are typically overrepresented in high schools as well as in programmes associated with the arts, health/social care and service fields, whereas male students are concentrated in programmes related to science, IT and technology. Although male-dominated vocational fields

⁴ Among 16-year-olds in 2014, first-choice applicants to upper secondary education were somewhat more likely to receive a study place offer on the vocational (87%) compared to the academic track (82%). Study place offer rates were lowest among first-choice applicants in vocational programmes related to the arts and humanities (72%) and health and social welfare (78%). Female applicants were more often selected to their first choice than their male peers in all fields except agriculture. Among all applicants, 96% of those offered a high school place and between 84% (arts and humanities) and 94% (health and welfare) of those selected for a vocational programme accepted the offer (Vipunen Education Statistics Finland, 2023).

tend to be associated with higher pay, they are also characterized by on average higher unemployment risks compared to many female-dominated vocational programmes (Prix & Kilpi-Jakonen, 2022, tbls. 2–3). Overall, vocational qualifications in Finland may be considered as a safety net on the Finnish labour market. Silliman and Virtanen (2022) show that especially for applicants with middling prior school achievement, vocational education can bring long-term earnings premiums over entering academic tracks. Furthermore, while earnings of vocational graduates did not depend on their GPA in lower secondary school, high economic returns after completing the academic track were more strongly contingent on subsequent entry into and graduation from higher education, which is a more common outcome mainly for applicants with higher prior school achievement.

4. Data, variables and methods

Our starting point in this paper is a full-population data set compiled from administrative registers (Statistics Finland, 2023a) comprising all children born in Finland in 1993–1997 and living in mainland Finland during the year they turn 15 ($n = 306,234$). We link these children with information on their parents and their household for the preceding years when they were of compulsory school age (ages 7–15). Children not living with at least one biological or foster/adoptive parent at age 15 are excluded ($n = 6151$ or 2% of the data). Our analyses are restricted to those young people in the cohort who apply to upper secondary education during the spring of the year they turn 16 (91% of the cohort), which represents the normative point of transition in the Finnish upper secondary system. After listwise deleting observations with missing values on our independent variables ($n = 392$ or 0.1%), our final analytical data set comprises 272,847 children.

To determine the geographical distance of available educational alternatives, we rely on official published information on available programmes and their teaching locations (Finnish National Agency for Education, 2009–2013). The Regional State Administrative Agency for Eastern Finland compiled this information into a database for internal research purposes (Koskela, 2020), which they have kindly made available for our study.

4.1. Dependent variables

Our first set of analyses focuses on young people's first-ranked *upper secondary track* (either academic or vocational) on their application. Further models differentiate this outcome variable to include also the particular *field of study* if a vocational programme is ranked first, divided according to six broad fields of study based on an aggregated classification standard used by the Finnish National Agency for Education. Combining track and field information, the resulting variable can take on seven values: academic education (=high schools), arts (incl. humanities and education), business and administration, engineering (incl. IT and natural sciences), agriculture, health and social care, and hospitality.

Most of our analyses focus on applicants' *first-ranked option*, but supplemental analyses extend the view also to the *next-best upper secondary programme* that young people considered. As applicants may use several ranks in their preference order for the same type of programme (e.g., different academic high schools, or the same type of vocational programme in different locations), this next-best choice (which excludes the first-ranked option from the choice set) does not necessarily strictly coincide with the second rank. Rather, it represents the first alternative in terms of track or field that applicants considered aside from their first choice.

4.2. Key independent variables

We measure *geographical distance* as the driving time from young people's home postcode (at the end of the year when they turn 15) to the

exact address of the nearest upper secondary institution, using OpenStreetMap data via the *osrmtime*-package (version 1.3.3) for Stata (Huber & Rust, 2016). This distance is calculated separately for the nearest vocational school and the nearest academic high school. For our analyses that differentiate upper secondary choices by (vocational) fields, we separately calculate the driving time to the closest high school and each of the six broad vocational fields outlined above. In more sparsely populated contexts, distances to education and services more generally may be longer, but at the same time, it is likely that additional smaller distances may decrease in relevance. In order to accommodate this non-linear relationship between distance and young people's educational application patterns, we log-transform driving times in all our logit models. For interpreting our results, we present average predicted probabilities and average marginal effects for specific driving time intervals based on their original scale (in minutes). Table 1 describes applicants' average geographical distance to upper secondary tracks and broad vocational fields.

Our operationalization of social background relies mainly on *parents' education*, using as our reference the parent with the highest educational attainment level when the child was aged 15. We differentiate between basic education, upper secondary qualifications, short tertiary qualifications (incl. bachelor degrees and other post-secondary qualifications), and master's (incl. higher) degrees. As our key proxy for social origin, we focus on parental education, which previous research has highlighted as the most important dimension of family background when predicting children's social educational outcomes in the Nordic context (Mastekaasa & Birkelund, 2023; Thaning, 2021). Parental education is relevant not only as it measures parents' own familiarity of different educational pathways in the educational system, but it serves as a broader proxy for social origin in this paper, given its association with children's socioeconomic circumstances (see also Table S.1. in the Online Appendix). In a set of robustness analyses added to the Online Appendix (Figures S.1-S.3), we replicated key analyses using additional and alternative measures of social background, such as parents' social class (operationalized by the Erikson-Goldthorpe-Portocarero (EGP) class scheme) and the average income of the household in which children lived between age 7–15 (deflated and measured in percentile ranks).

4.3. Controls

Including applicants' *grade point average* (GPA) achieved at the end of lower secondary education helps us separate out such social origin associations that derive from applicants adjusting their plans to their predicted admission chances. We control for children's *native language*, given the previously observed higher average educational attainment levels observed among the Swedish-speaking minority in Finland (Härtull & Saarela, 2021). Adding *migration background* aims to accommodate the higher average educational aspirations observed among children of immigrants in Finland (Kilpi-Jakonen, 2011). We also include the *family type* children lived in at age 15, as it may have both socioeconomic and socialization consequences that affect children's educational aspirations.

Young people living in more sparsely populated areas may have adapted to longer distances, while variations between urban and rural infrastructure can affect effective distances within the same region. As such, young people's perception of which distances are considered long or costly may not only depend on their absolute length (Pulkkinen & Rautopuro, 2018), but vary regionally and between rural and urban areas. At the same time, vocational schools adapt their educational programmes also to local labour market structures (Stenström & Viro-lainen, 2014), which may affect the overall popularity of particular upper secondary options across regions. To control for the possible confounding of our distance measures by these issues, we include controls for the (NUTS2-classified) *region in Finland* as well as the degree of *urbanization* of applicants' home municipality at the end of the year in

which applicants turned 15. Furthermore, our field-specific models also control for *field-specific unemployment rates* during each application year in the sub-regional unit to which applicants' home municipality belongs.

Table 2 provides an overview of the geographical variation of distances to upper secondary education for our data. For an overview of all variables used in our analyses, please refer to Table 3.

4.4. Method

Our first research question focuses on the choice between high schools and vocational schools, which is why our first set of analyses relies on *binary logit models*. We present these results in terms of average marginal effects, as we consider probabilities as more intuitive and relevant for interpreting the results than the (log) odds scale (Mize, 2019). For interpreting interactions on the probability scale, we derive average marginal effects of distance conditional on parental education. This means that we marginalize over other covariates within each social background group. This approach provides more realistic predictions than alternative calculation methods (Long & Freese, 2014, pp. 280–286), which we consider important given the sensitivity of average marginal effects to baseline probability rates (Norton & Dowd, 2018). However, a main drawback lies with the fact that group-specific differences in distance sensitivity calculated in this way will be influenced by the fact that school achievement varies across social origins (see also Table S.1), which will hinder the comparability of distance sensitivity if applicants adjust their application preferences to realistic admission probabilities. To address this issue, we hold applicants' GPA at its (sex-specific) grand mean when deriving group-specific average marginal effects and average probabilities from our interaction models. In this way, we hope to preserve a level of realism by measuring applicants' distance sensitivity conditional on their observed social and regional context, but ensure comparability across groups by focusing our interpretation on the idealtypical case of applicants with the same, average school achievement.

Once we extend our analyses to differentiate between track and vocational fields of study (research question 2), we draw on *mother logit models*. Similar to conditional logit analyses, these models accommodate both individual-specific variables (i.e., characteristics of applicants) and alternative-specific variables (i.e., characteristics of the outcome alternatives). However, mother logit models additionally include cross-effects, which means that the choice of a given outcome alternative can depend also on the characteristics of competing alternatives. Due to the specification of such cross-effects, mother logit models (unlike multinomial and conditional logit models) circumvent the independence of irrelevant alternatives -assumption (IIA), which facilitates the use of these models for examining substitution patterns (Steenburgh, 2008).

Our mother logit models use a very flexible specification, where distance associations are allowed to vary between different tracks/fields as well as by parental education (modelled as the three-way interaction distance×alternative×parental education). We interpret the results based on average predicted probabilities (estimated for applicants with mean GPA) conditional on parental education, comparing different field/track-specific distance constellations of three key educational alternatives: high schools, engineering, as well as health and social welfare. As absolute distances vary between regions, we take the closest

Table 2

Driving distances (in minutes) to the nearest upper secondary branches (2009–2013), by region and upper secondary track.

Region	High school distances				Vocational school distances			
	Mean	Std. dev.	Lower quartile	Upper quartile	Mean	Std. dev.	Lower quartile	Upper quartile
Helsinki/Uusimaa	6.8	5.4	3.4	8.2	8.1	6.0	4.2	10.1
South	11.2	10.6	5.4	13.9	13.9	12.6	6.3	17.7
West	11.8	8.0	6.6	14.9	15.0	11.7	6.8	20.6
North/East	14.4	12.4	6.1	18.5	18.6	16.9	7.1	26.6
Total	11.0	9.8	4.8	13.8	13.8	12.9	5.4	17.2

Table 3

Descriptives of variables used in the analyses.

A. Frequency distributions by gender (column %)						
Categorical variables	Girls	Boys	Total			
First-ranked track						
Vocational school	38.7	53.3	46.0			
High school	61.3	46.7	54.0			
First-ranked broad field						
General	61.3	46.7	54.0			
Humanities/Culture	4.1	2.0	3.0			
Business	5.2	4.5	4.8			
Engineering/IT	5.3	40.3	22.8			
Agriculture/Nature	2.1	1.9	2.0			
Health/Social	15.3	1.7	8.5			
Hospitality	6.6	2.9	4.8			
Parents' education						
Basic	3.6	3.4	3.5			
Upper secondary	37.8	37.1	37.5			
Short tertiary	39.5	39.7	39.6			
Master's or higher	19.1	19.7	19.4			
Family type at age 15						
Lived with both parents	66.0	67.1	66.5			
Single parent	21.9	21.0	21.4			
Stepfamily	12.2	11.9	12.1			
Migration background						
Native/mixed heritage	98.8	98.9	98.8			
Both parents immigrated	1.2	1.1	1.2			
Home municipality's urbanisation						
Urban	64.3	64.3	64.3			
Semi-urban	18.9	19.1	19.0			
Rural	16.8	16.6	16.7			
NUTS region						
Helsinki/Uusimaa	27.1	27.3	27.2			
South	21.2	21.0	21.1			
West	25.6	25.8	25.7			
North/East	26.1	25.9	26.0			
Native language						
Finnish	93.5	93.6	93.5			
Swedish	5.3	5.3	5.3			
Other	1.2	1.1	1.1			
B. Means and standard deviations (SD) by gender						
Continuous variables	Girls		Boys		Total	
	Mean	SD	Mean	SD	Mean	SD
Shortest high school distance (minutes)	11.0	9.8	11.0	9.8	11.0	9.8
Shortest vocational school distance (minutes)	13.8	12.9	13.8	12.9	13.8	12.9
GPA in lower secondary school (range: 4-10)	8.0	1.0	7.5	1.1	7.7	1.1
Number of observations	136,485		136,362		272,847	

locally observed distance to the nearest high school as the locally "closest" distance for our counterfactual scenarios. In the reference scenario, all three key alternatives are set to this distance. In scenarios where two of the key fields are defined as further away, we set their distance as being located 15 min further away than the two other key fields. The distance of the relatively "closer" option remains set to that of the nearest high school. Distances to other programmes than the key three fields are kept at their observed values in all scenarios.

Note that not all of these relative distance constellations are equally common empirically. For instance, in our data, high schools are very

rarely more distant than health and engineering programmes. Furthermore, it is fairly common that health programmes are located at a longer distance than engineering, while the reverse is very rare.

Although mother logit models have been discussed since the 1970 s, they have only been sparsely used in economics (and to our knowledge, not at all in sociology), perhaps because they may produce results that do not align with random utility modelling (RUM) expectations (Hess et al., 2018; Steenburgh, 2008). However, given that RUM theory has itself been criticized for a lack of realism (reviewed in Hess et al., 2018), and does not in its classic form constitute the theoretical point of departure for this article, we argue that this feature of the mother logit model does not impede our analytical purposes.

As our analyses are based on full population rather than sample data, traditional statistical inference plays a lesser role in this paper. Although we nevertheless report standard errors and p-values, we interpret the results based on substantive effect sizes rather than statistical significance.

5. Results

5.1. How does geographical distance matter for the choice between vocational and high school tracks?

Examining how geographical distance is on average reflected in young people's application patterns to upper secondary education, we first estimated a main effects binary logit model for the choice between high schools and vocational schools (Table 4, equivalent to Model 2 of Appendix Table A.1). With increasing travel distance between their home and the nearest high school, applicants appear to be on average less likely to select high schools as their first choice on their upper secondary application, net of other controls in the model (Table 4, in line with expectation 1). A nonlinear relationship between distance and high school preferences is also obvious from these results, with a ten-minute increase in driving time more consequential in a context of shorter (5 min) rather than longer baseline driving times (30 min). On average, for a ten-minute increase in driving time to the nearest high school (compared to observed distances), our models estimate a decrease in the probability of applying to this track by on average 2 percentage points (pp) in the case of girls and 3 pp for boys. This slightly higher sensitivity to geographical distance among boys compared to girls replicates previous research and conforms to our expectations (expectation 2). For applicants with mean GPA, this average distance sensitivity is even more pronounced and characterized by increased gender gaps (−3 pp among girls, −5.6 pp among boys, Table 4). Note, however, that not all distances are equally relevant. For both girls and boys applying to upper secondary education, longer distances to vocational school only barely (by less than a percentage point for a ten minute increase) increase applicants' interest in high schools (Table 4), whereas longer driving times to the nearest high school more clearly deter some applicants from selecting high schools as their first-ranked choice.

To examine whether distance sensitivity depends on social origin, we next model the interaction between parental education and the shortest driving times to each upper secondary track. For the interpretation of results, we compare model-based average predicted probabilities of applying to high schools as their first choice for applicants from different social backgrounds, who nevertheless achieved the same average grades in lower secondary school. Among girls (Fig. 1, left panel), distance sensitivity displays a noticeable social gradient (in line with expectation 3a). Accordingly, the driving time between home and high school appears to matter comparatively least for girls with tertiary educated parents (−3 pp for a ten-minute increase in observed driving time). Daughters of parents with shorter qualifications, on the other hand, appear more sensitive to the geographical accessibility of high schools, with a ten-minute increase in driving time lowering their probability to rank high schools as their first choice by 3.6 pp (if their parents have an upper secondary qualification) and 5.6 pp (if parents have only basic

education).

For female applicants from all social origin groups, the distance to vocational upper secondary schools appears to be clearly less significant for deciding on the first-ranked upper secondary track compared to driving times to the nearest high schools (in line with expectation 3b). Regardless of social origin, the distance to the nearest vocational school affects girls' probability of ranking high schools as their first choice by less than 1 pp (Fig. 1, left panel).

Among boys with average school achievement, distance sensitivity patterns deviate more strongly from our expectations (Fig. 1, right panel). Surprisingly, high school distances appear to play a similar role for deciding on the first-ranked track among the sons of highly-educated parents as among their peers whose parents have upper secondary qualifications (against expectation 3a). For these groups, longer driving times to high schools decrease the probability of selecting this track as their first choice by a similar extent (of about 5 pp for a ten-minute increase). The strongest reaction to high school distances, on the other hand, is observed among the sons of parents with short-tertiary qualifications (−6.7 pp for a ten-minute driving time increase). Among boys from all social backgrounds, driving times to vocational school matter less than those to high schools for their ranking of upper secondary tracks (in line with expectation 3b). However, sons of parents with upper secondary qualifications are comparatively most likely to consider high schools with increasing distance of vocational alternatives (by about 1–1.6 pp for a 10-minute increase in driving time to the nearest vocational school). In other words, the absence of vocational alternatives may play a larger role for boys' rather than girls' high school applications, particularly among sons of parents with upper secondary qualification.

5.2. Compromises between tracks and (gender-typed) fields of study by social origin

Next, we examine to what extent applicants may consider high schools, (male-dominated) engineering, and (female-dominated) health and social welfare fields as possible substitutes if their relative proximity differs. To do so, we rely on mother logit models that include all cross-effects and three-way interactions between alternatives, distances and parental education.⁵ We interpret results comparing model-based average predicted probabilities between several (hypothetical) scenarios, for which we manipulate the distance of three key alternatives: high schools, engineering, and the health and social welfare field. The reference scenario describes a situation where all three options are equidistant, using the observed distance of high schools as the reference distance for all three fields (leftmost column in Fig. 2 and Fig. 3, respectively). As in the previous section, our discussion of results focuses on applicants with average school achievement.

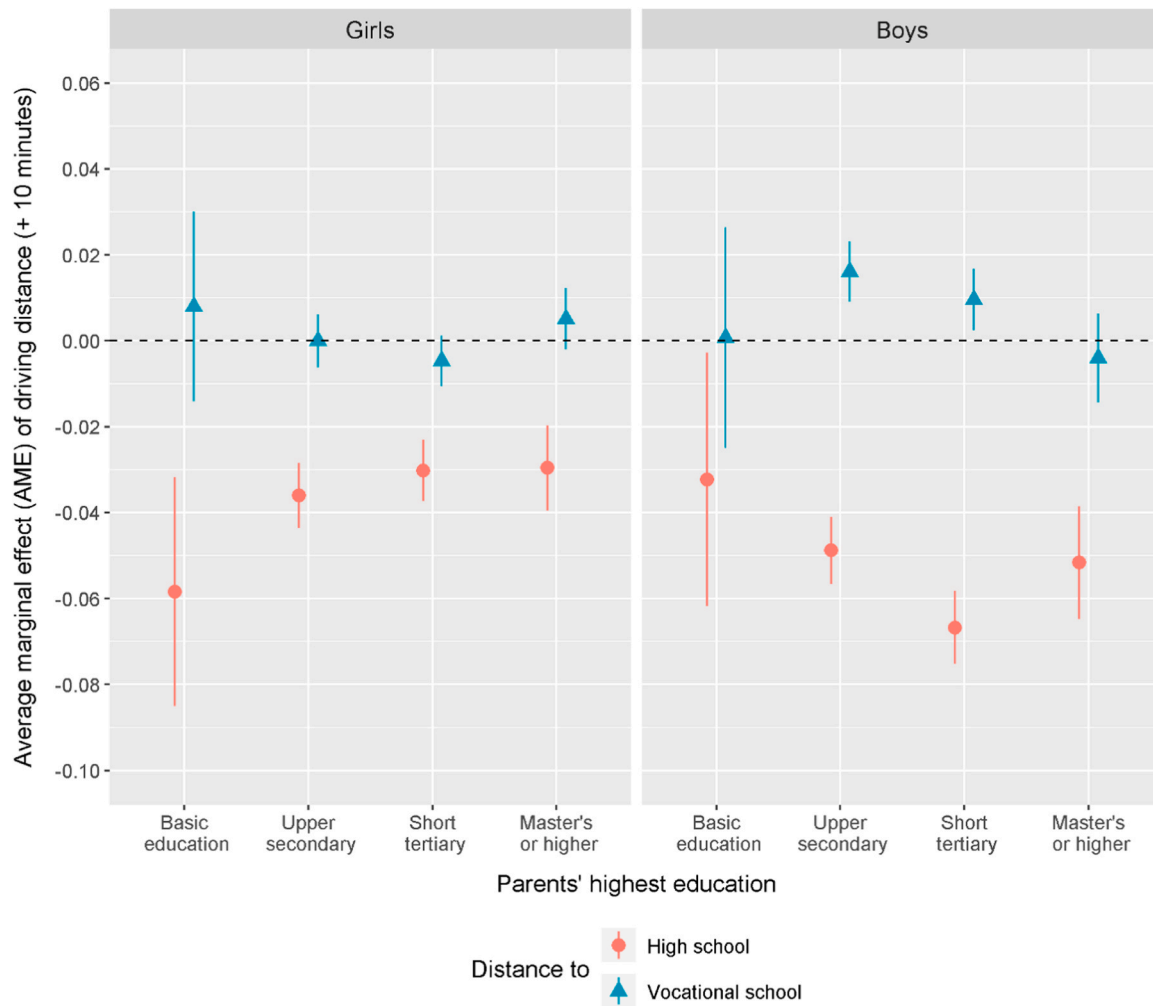
Among girls with average grades, a first-ranked high school application is 30 pp more likely for daughters of highly-educated rather than low-educated parents, if key upper secondary alternatives are equidistant (Fig. 2, reference scenario, top row). In a scenario where high schools are in relatively closer proximity than health or engineering, the model predicts a slight increase in first-ranked high school applications particularly among girls with low-educated parents (Fig. 2, second column from left, top row). Conversely, while the absence of nearby high schools lowers first-ranked high school applications across the board (Fig. 2, third and last column from left, top row), the predicted reduction is particularly pronounced among these girls with low parental education (by about 7 pp or 14%). This further exacerbates the clear social gradients in first-ranked high school applications observed in the

⁵ Goodness-of-fit indicators for our mother logit models surpassed those of equivalently specified conditional logit models in terms of both likelihood ratio tests and the Akaike Information Criterion (AIC). Model fit for mother logit models with differing interaction specifications (two-way vs. three-way) varied marginally, but remained very close overall (see Appendix Table A.2).

Table 4

Average marginal effects (AME) of upper secondary distances and their standard errors (SE), comparing the association of different ten-minute intervals at different baseline distances with applicants' probability to rank high schools as their first choice. Estimates based on binary logit models (derived from Model 2 in Appendix Table A.1).

Distance variable	Contrast	Girls			Boys		
		AME	SE	p-value	AME	SE	p-value
Distance to the nearest high school	from 5 to 15 min	-0.028	0.002	0.000	-0.039	0.002	0.000
	from 30 to 40 min	-0.008	0.001	0.000	-0.010	0.000	0.000
	+ 10 min	-0.022	0.002	0.000	-0.031	0.001	0.000
	+ 10 min (at mean GPA)	-0.033	0.002	0.000	-0.056	0.003	0.000
Distance to the nearest vocational school	from 5 to 15 min	-0.001	0.002	0.694	0.007	0.002	0.000
	from 30 to 40 min	0.000	0.000	0.694	0.002	0.000	0.000
	+ 10 min	-0.001	0.001	0.694	0.005	0.001	0.000
	+ 10 min (at mean GPA)	-0.001	0.002	0.694	0.009	0.002	0.000



Note: GPA held at sex-specific grand means.

Fig. 1. Distance sensitivity regarding the top-ranked upper secondary track by parental background. Average marginal effects based on binary logit models with parental education×high school distance and parental education×vocational school distance -interactions.

reference scenario.

In a scenario where (male-dominated) engineering is relatively more accessible than other key alternatives, our model predicts a greater increase in engineering applications among girls with low-educated parents compared to their peers from other social origins (Fig. 2, third column from left, middle row). By the same token, the results suggest that girls with low-educated parents are similarly more open to (gender-typical) health and social welfare programmes if this alternative is the most proximate option (Fig. 2, fourth column from left, bottom row).

These results suggest that girls from less advantaged social origins may be more likely to consider pragmatic compromises in terms of their first-ranked field's sex type compared to their peers with higher levels of parental resources. When extending the view to the next-best ranked options, the model suggests that such pragmatic compromises in terms of gender-atypical fields lose much of their social gradient and increase also among daughters of medium- and higher-educated parents (Appendix Figure A.1, second column from the right, middle row).

Among boys with average grades, we find even stronger social

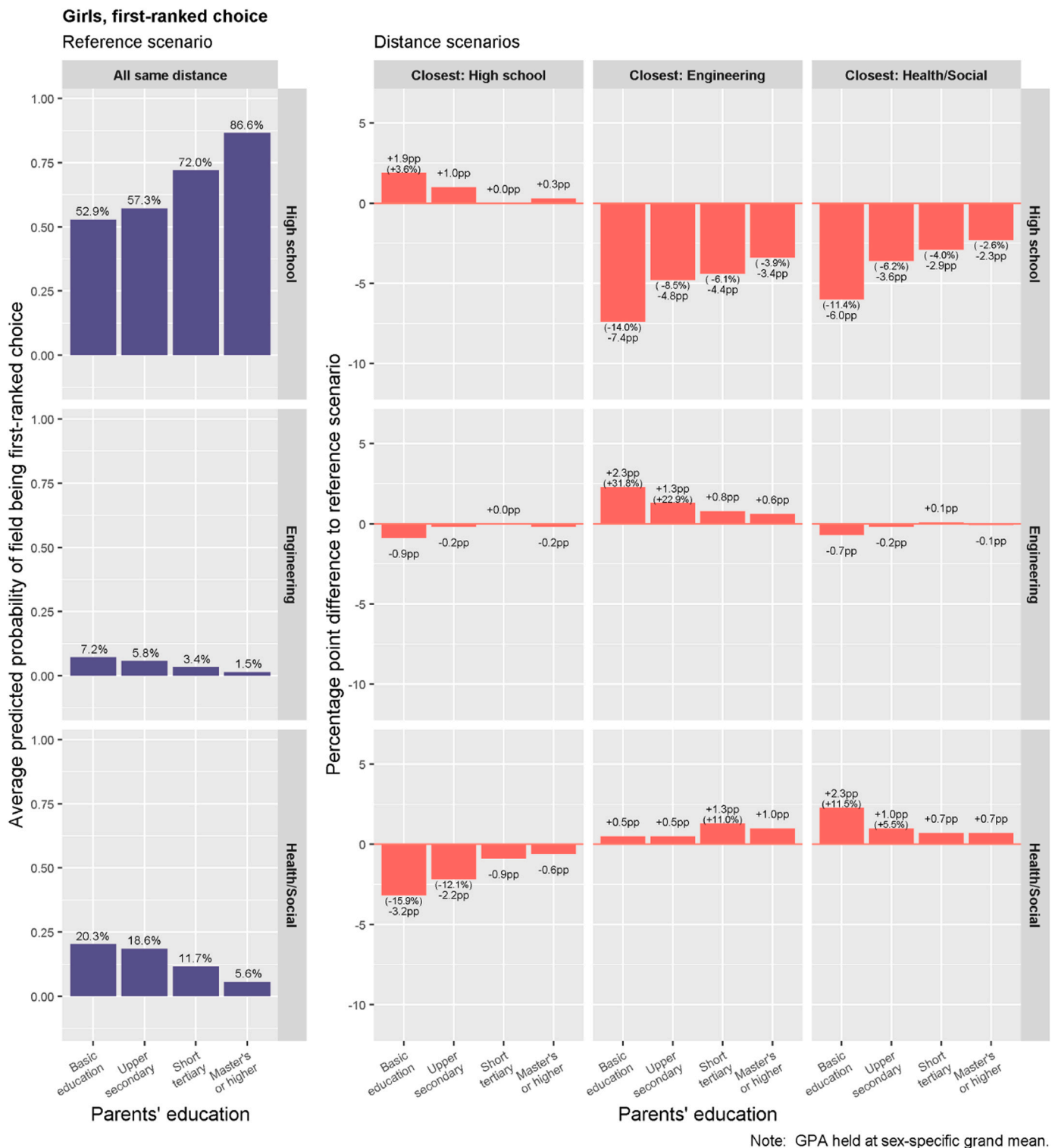
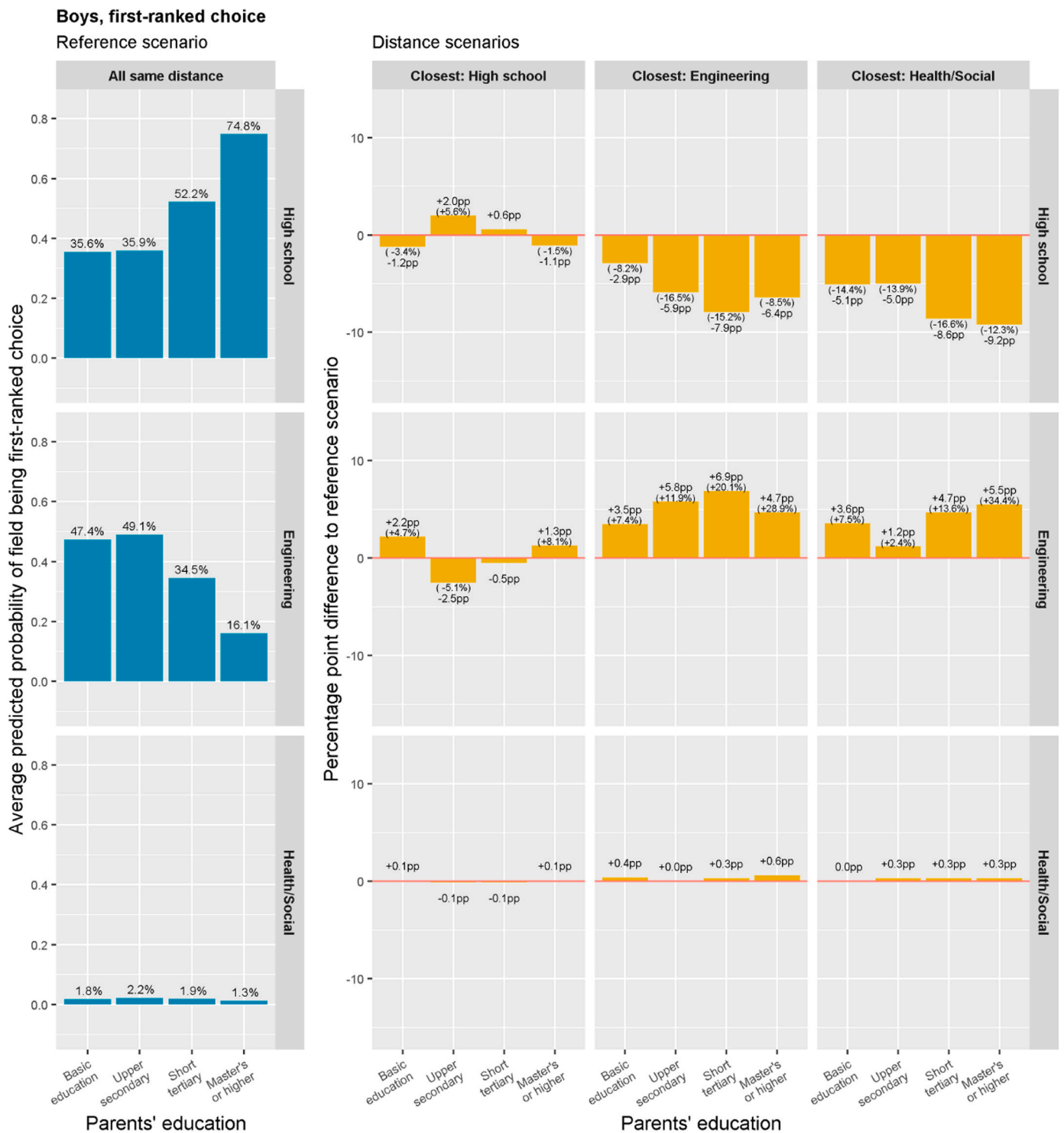


Fig. 2. Girls' first-ranked choice by parental education and educational distance scenario. Average predicted probabilities in three hypothetical scenarios compared to a reference scenario (leftmost column). Results based on mother logit models with a three-way distance×alternative×parental education interaction. For included predictors and goodness of fit statistics, see [Appendix Table A.2](#) (MoL model 2, girls).

differentials among first-ranked high school applications in the reference scenario, with an overall lower baseline share of boys who primarily apply to the academic track compared to girls (Fig. 3, first column from left, top row). Engineering is the most popular choice for the sons of parents with basic and upper secondary education (Fig. 3, first column from left, middle row), whereas the female-dominated health and social welfare field is decidedly unpopular among male

applicants regardless of social origin (Fig. 3, first column from left, bottom row).

While our binary models had focused on the isolated role of upper secondary track distances, the findings of our mother logit models provide further nuances to how the distance constellation of key alternatives may differentially affect the application patterns of boys from lower- and higher educated social origins. If high schools are the closest



Note: GPA held at sex-specific grand mean.

Fig. 3. Boys' first-ranked choice by parental education and educational distance scenario. Average predicted probabilities in three hypothetical scenarios compared to a reference scenario (leftmost column). Results based on mother logit models with a three- distance×alternative×parental education interaction. For included predictors and goodness of fit statistics, see [Appendix Table A.2](#) (MoL model 2, boys).

alternative, boys whose parents have upper secondary qualifications are predicted as most likely to mildly increase (by 2 pp or about 6%) their share of first-ranked high school applications (Fig. 3, second column from left, first row) at the expense of (more distant) vocational engineering programmes (Fig. 3, second column from left, middle row). Although our previous models did not find a larger sensitivity to high school distances among boys with lower- rather than higher-educated

parents (expectation 3a), these results suggest an overall higher sensitivity of lower-educated boys to the relative proximity of high schools over engineering programmes, which remains broadly in line with our theoretical expectations.

On the other hand, if high schools are further away than other key options, the model predicts the clearest repercussions in the application patterns of boys with short-tertiary and highly-educated parents. In this

scenario, first-ranked high school applications are predicted to decrease in these groups by about 6–9 pp, equivalent to a reduction of roughly 9–16% in relative terms (Fig. 3, third and fourth column from left, top row). In terms of substitutions, (gender-typical) engineering absorbs the largest part of these applicants, especially if engineering programmes are the relatively closest alternative (Fig. 3, third and fourth column from left, middle row). However, in the scenario where (gender-atypical) health programmes are more easily accessible than other alternatives, our model predicts no noteworthy increase in first-choice applications to (gender-atypical) health and social welfare programmes (Fig. 3, fourth column from left, bottom row) among boys (against expectation 4).

Distance appears to matter also for boys selecting the next-best programme on their application (Appendix Figure A.2). Overall, social gradients in the application to next-best programmes disappear or diminish fairly drastically among boys with average grades (Appendix Figure A.2., first column on the left). If high schools are the relatively closest option, particularly boys with low-educated parents are more likely to consider this track as their next-best option. For male applicants who have not opted for a high school programme as their first choice, relatively longer travel times to appear to again discourage high school applications, particularly among the sons of parents with upper secondary qualifications (Appendix Figure A.2, third and fourth column). The popularity of engineering increases in a similar fashion across all social backgrounds, if engineering is the relatively closest alternative. While health and welfare programmes clearly more popular as a next-best rather than a first-ranked field among boys, this field does not appear to draw a large share of boys making geographical compromises, as relative geographical proximity does not improve its popularity among boys (Appendix Figure A.2, fourth column from left, bottom row). Instead, in the absence of both high schools and engineering as the closest alternative, boys' tend to turn towards business as the next-best field on their application (not shown).

5.3. Robustness checks

To establish whether the focus on parental education as our single proxy for social origin affects our results, we repeated our analyses and adjusted our binary models for household income and parental class. This had no repercussions on our key results (Online Appendix, Figure S.1). In addition, we re-estimated the interactions of our binary model with different social origin variables, using parents' social class (Online Appendix, Figure S.2) and applicants' household income during childhood (Online Appendix Figure S.3) as the moderator variables interacted with upper secondary distances. In the case of parental class, social origin gradients in distance sensitivity were overall fairly flat among girls, but daughters of low-skilled parents displayed greater distance sensitivity than their peers from more advantaged class backgrounds. Among boys, we found again a u-shaped pattern in distance sensitivity broadly comparable to our parental education gradients, although sons of the skilled and low-skilled working class appeared to clearly differ in their distance responses (Online Appendix, Figure S.2). No interactions on the probability scale were detected in the case of household income, however, which appears to affect application patterns in an additive rather than interactive way (Online Appendix, Figure S.3). Overall, these additional results are broadly in line with previous research that highlighted the dimension-specificity of associations between parental resources and children's stratification outcomes (Mastekaasa & Birkelund, 2023; Thaning, 2021).

Finland is not only sparsely, but also very unevenly populated, which also means that distances to education can vary substantially between different regions (see also Table 2). To examine how sensitive the model averages reported in this study are to regional variation, we estimated separate models of first-ranked track and field/track combinations for each of the four NUTS2 regions of mainland Finland (Helsinki-Uusimaa, Southern Finland, Western Finland, Northern and Eastern Finland). Our

key findings replicated in most of these analyses, but also some regional variations emerged. We present these results alongside a more detailed description of key regional variations in the online appendix to this article (with interactions from region-specific binary models region-specific mother logits presented in Figures S.4 and Figures S.5-S.12, respectively).

6. Discussion and conclusion

Geographical accessibility is an increasingly recognized dimension of educational inequality in the sociological literature, although much research in this field has concentrated on tertiary education. In this article, we examined whether geographical distance and proximity might modify the salience of social constraints and opportunities for young people's upper secondary applications, by which we contributed a new angle on common explanatory accounts of social and gender inequalities in education. The rich, large-scale data on application patterns available to our study, linked with geographical distance measures of educational options, enabled us to observe young people's educational plans before any institutional selection processes took place. As such, we were also better able to accommodate the diversity of educational alternatives that young people consider at this stage, of which we differentiated the alternatives they ranked as their first and as their second-best choice.

Our results showed that on average, geographical accessibility of education matters for young people's upper secondary pathways. In deciding on their top-ranked upper secondary choice, we found young people to be on average more sensitive to the geographical distance of high schools, whereas travel times to the nearest vocational school appeared less significant for their choice of track. This suggests that applicants treat educational distances asymmetrically. Since applications to vocational schools imply the decision for a particular, fairly occupation-specific programme, the lower sensitivity to their location suggests that geographical proximity alone may not compensate for a possibly otherwise undesirable vocational specialization. High schools, on the other hand, perhaps due to their emphasis on general education, appear to be more likely to sway some applicants for more pragmatic reasons, if they are located closer to young people's home areas. We caution against misinterpreting this finding as implying that travel times to vocational schools do not matter to young people. Although distance may not discourage young people from applying to vocational schools, previous research has shown that longer travel times increase young people's risk of dropping out of upper secondary education (Falch *et al.*, 2013; Virtanen & Riukula, 2021).

The question as to whether proximity incentivizes pragmatism is also relevant from a perspective of understanding social origin differences in educational pathways. In line with expectations derived from risk aversion accounts, we found that particularly daughters of highly educated parents were comparatively less sensitive in their upper secondary track choices to where high schools are located. For girls whose parents had received lower qualifications than a master's degree, on the other hand, we found stronger associations between upper secondary track choices and the geographical distance of educational alternatives. These social origin differentials in distance sensitivity are more in line with risk aversion accounts than with culture-based arguments. Rather than being systematically alienated from the educational system, daughters of parents with lower "cultural capital" in our study showed increased interest in academic pathways if geographical accessibility made such options more feasible. This finding aligns with the idea that what separates children of different backgrounds on their pathway through the educational system may be less a matter of class-specific culture than differences in uncertainty and risk, which geographical opportunity may to some (limited) extent either alleviate or aggravate.

However, the decidedly gendered ways in which social gradients of distance played out in our study also complicate an all too straightforward risk aversion interpretation. Daughters of parents with shorter

qualifications were indeed most likely to adjust their upper secondary plans to the proximity or distance of high school options. However, boys from low-educated backgrounds may be less swayed by the distance or proximity of high schools (net of vocational distances) than we expected. Rather, it was sons of parents with short-tertiary qualifications who were more likely to adjust their first preference to the geographical accessibility of high schools. However, further nuances in these gender differences emerged once we extended our analyses to compare relative distance constellations of track- and field-specific educational alternatives. In particular, the relative proximity of the academic track compared to key vocational options, particularly male-dominated vocational engineering, did appear to slightly raise high school preferences among sons of parents with upper secondary qualifications. Overall, for male applicants with low-educated parents, thresholds to consider high school pathways appear to be less malleable by structural opportunities arising through proximity than we expected.

With regard to possible gender-(a)typical substitution patterns in varying (counterfactual) scenarios of field- and track-specific distance constellations, our models predicted particularly girls from lower-educated social backgrounds as slightly more prepared to consider fields of study not typical for their gender than their advantaged peers. High levels of (parental) education may thus not in itself weaken young people's gender-stereotypical interests, and neither does the defiance of gender-stereotypical expectations appear to necessarily require high levels of cultural capital. It may be the case that challenges to gender-normative expectations are not exclusively rooted in progressive gender ideology, but can also emerge as a pragmatic adaptation to constraints (Usdansky, 2011). Boys, on the other hand, substituted the absence of easily accessible high schools mainly via gender-typical vocational options, even if these were similarly distant as high schools. More rigid gender norms for men than women may be one aspect contributing to this finding (Bosson et al., 2022), which may lead to somewhat greater pragmatic leeway for girls rather than boys.⁶ Additionally, the average earnings benefit associated with male- rather than female-dominated fields (Prix & Kilpi-Jakonen, 2022, tbls. 3–4) may lead to an increased threshold for gender-atypical substitutions for boys compared to girls. Although also lower employment security is associated with some male- compared to female-dominated vocational fields, these may be less salient for boys of this age, given the lower relevance of job security-related work motivations previously reported for male compared to female adolescents in Finland (Sortheix et al., 2015).

To what extent distance to upper secondary education truly alters the risk and uncertainty young people associate with different upper secondary tracks cannot be definitively established within the context of this research. Furthermore, it is possible that institutional features differentially affect boys and girls as they consider their next steps on their way through the educational system. In systems like the Finnish one, where critical educational turning points coincide with pupils' late adolescence, previous studies have found more pronounced sex differences in attainment and upper secondary track choice, although it is unclear whether sex differences in (non-)cognitive development play a role for explaining this pattern (Scheeren & Bol, 2022). If the timing of upper secondary transitions falls into a "critical" period for development, this may also affect social origin and sex differences in the response to geographical constraints. Furthermore, as dead ends within the Finnish educational system are increasingly dismantled (exemplified by widespread possibilities to integrate high school subjects into a vocational qualification as a "double degree", or *kaksoistutkinto*), pressures to compromise between "safe" vocational options and future

academic pathways may subside even further. This may explain why proximity advantages of high schools did not lead to an increase of high school preferences among the sons of the lowest-educated parents. If gender-typical vocational pathways with fairly positive labour market outcomes for those with average school achievement (Silliman & Virtanen, 2022) do not necessarily come at the cost of excluding prospects for academic upward mobility aspirations, particularly boys from low-educated social origins may simply not perceive the proximity of high schools as sufficiently salient for re-assessing their educational options. Further research into how constraints may translate into gendered educational compromises is needed.

Finally, it is important to acknowledge several limitations characterizing this research. To start with, we focused our interpretation on applicants with average school achievement, which somewhat limits the external validity of our results. School achievement is likely to moderate distance sensitivity in application patterns, which we hope will be further studied in future research. Additionally, although the administrative nature of this study's data helped minimize attrition in our study, the fact that young people's home address information was available only at the level of postcodes introduced some measurement error and reduced variation in our calculation of track- and field-specific distances to education. As such, distance calculations remained approximate, particularly for the country's more sparsely populated north and east. Furthermore, while our mother logit models were able to circumvent the problem of unrealistic modelling assumptions (such as the IIA) underlying conditional and multinomial logit models, some of the scenarios we compared in our analyses are empirically relatively rare in Finland. In this sense, our results included what could be considered out-of-sample predictions, which future research needs to subject to further scrutiny using different types of methods and data. While our empirical analyses cannot determine the final causality of observed relationships in any definitive way, we expect the empirical and theoretical contributions of our study will assist future work with a more dedicated causal design.

Funding

This research has been supported by the INVEST Research Flagship Center, funded by the Academy of Finland Flagship Programme [grant number: 320162]. Irene Prix acknowledges partial funding by the Turku Institute for Advanced Studies. Juhani Saari's contribution was partly funded by the Kone Foundation (PAHE-project, PI: Sonja Kosunen).

Declaration of Competing Interest

None.

Acknowledgements

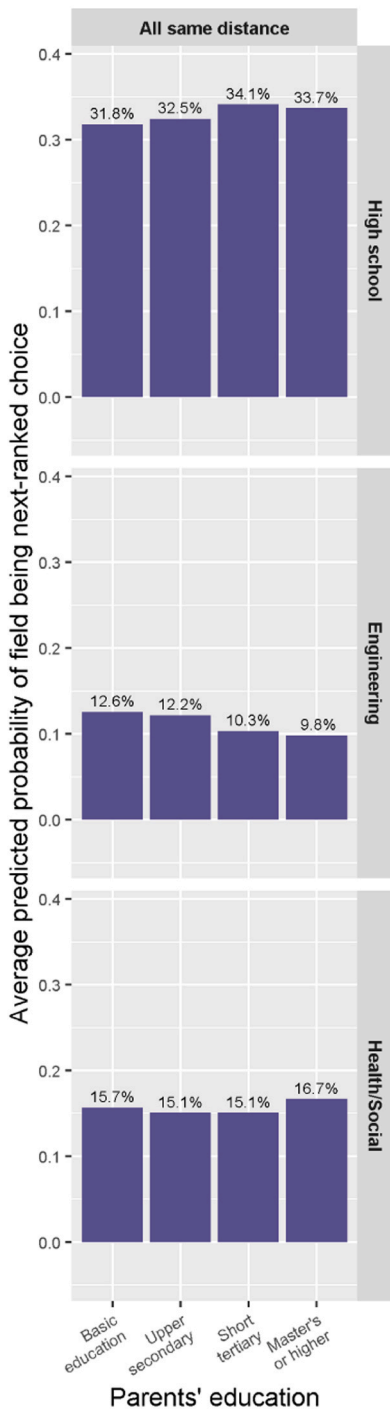
We thank Matti Koskela (Regional State Administrative Agency for Eastern Finland) for kindly providing this study with data on teaching location geocodes. Previous versions of this article have been presented at the ECSR annual conference (2018, 2021) and the RC28 Spring Meeting (2021), as well as in research seminars at the University of Turku, Finland (2021), the Finnish Institute for Health and Welfare (2021), and the University of Pavia, Italy (2022). We thank participants for their constructive feedback. All views and errors in this paper are the authors' own and should not be attributed to their affiliated organizations.

⁶ Overall, however, some caution must be applied in interpreting the gender-(a)typical substitutions found in this study, as the rather broadly defined fields of study may also contain internal gender segregation.

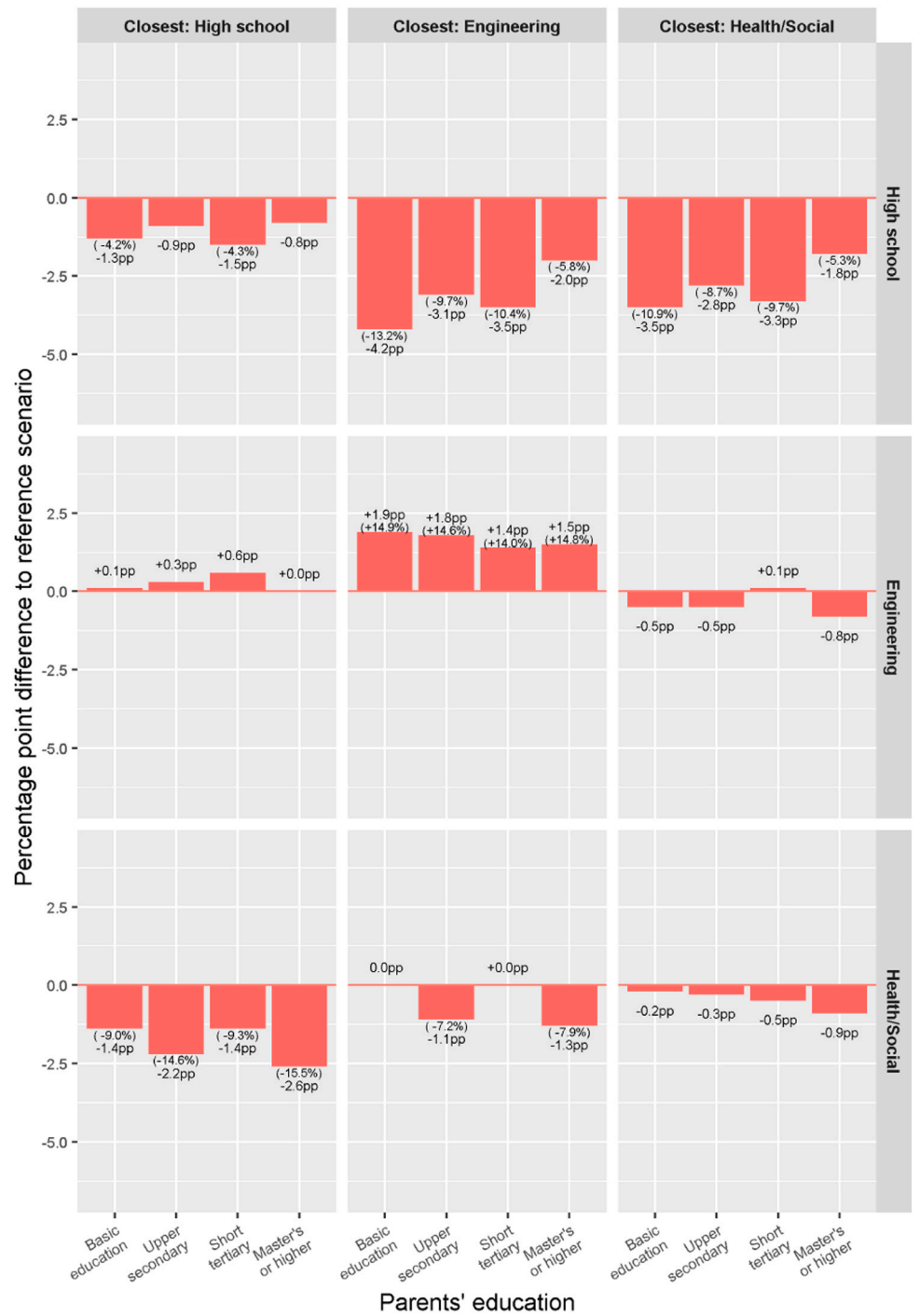
Appendix A

Girls, next-ranked choice

Reference scenario



Distance scenarios



Note: GPA held at sex-specific grand mean.

Figure A.1. Girls' next-ranked educational choice on their upper secondary application in four hypothetical scenarios. Average predicted probabilities in three hypothetical scenarios compared to a reference scenario (leftmost column). Results based on mother logit models with distance×alternative×parental education interaction. Model specification identical with Fig. 2.

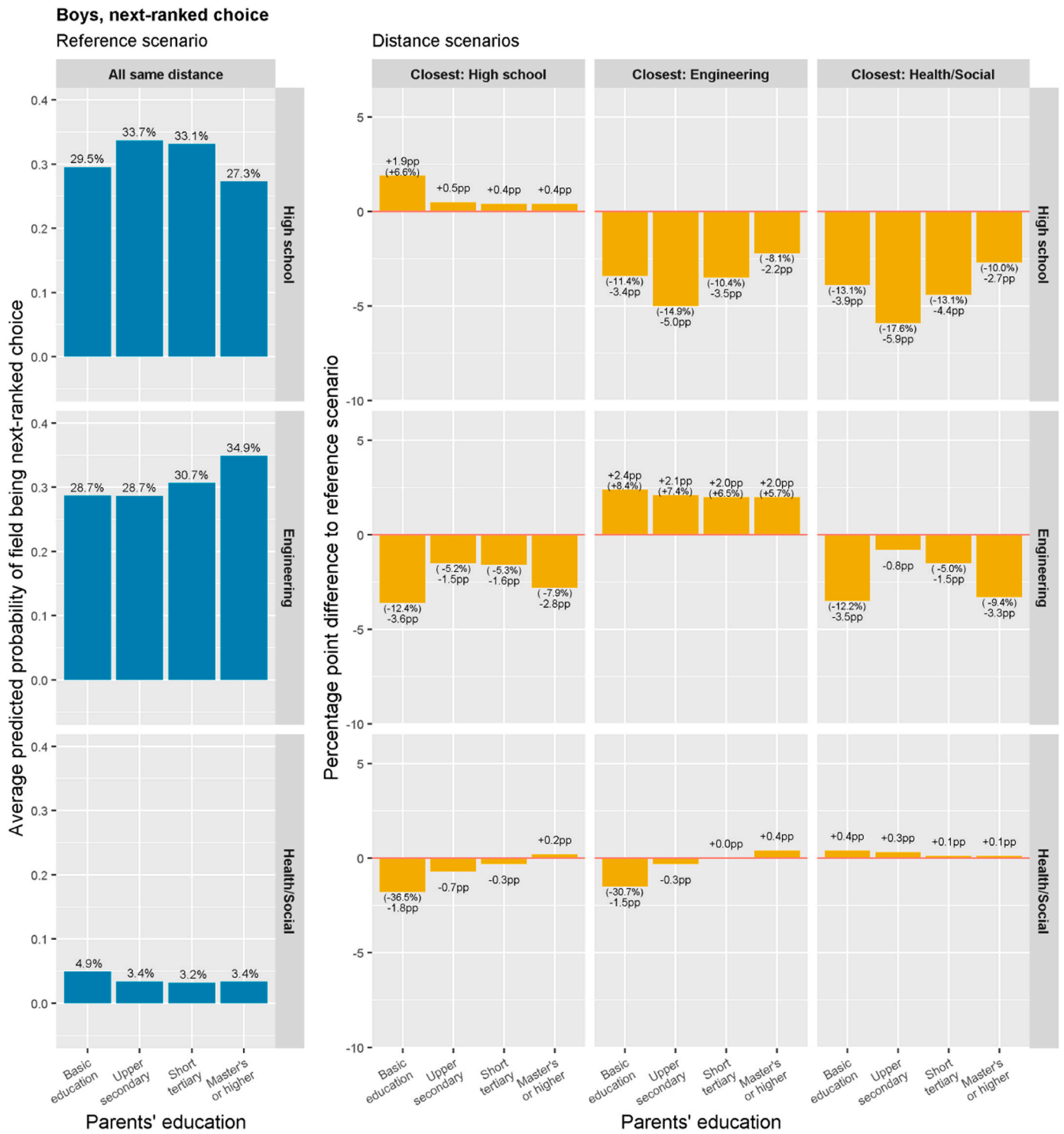


Figure A.2. Boys' next-ranked educational choice on their upper secondary application in four hypothetical scenarios. Average predicted probabilities in three hypothetical scenarios compared to a reference scenario (leftmost column). Results based on mother logit models with distance×alternative×parental education interaction. Model specification identical with Fig. 3.

Appendix Table A.1

Binary logit main effects model predicting ranking high schools as the first choice on their upper secondary application. Average marginal effects (standard errors in parentheses).

	Girls		Boys	
	Model 1	Model 2	Model 1	Model 2

(continued on next page)

Appendix Table A.1 (continued)

	Girls		Boys	
	Model 1	Model 2	Model 1	Model 2
Parents' education (ref. upper secondary)				
Basic	-0.048*** (0.007)	-0.049*** (0.007)	-0.031*** (0.007)	-0.033*** (0.007)
Short tertiary	0.089*** (0.002)	0.088*** (0.002)	0.084*** (0.002)	0.082*** (0.002)
Master's or higher	0.200*** (0.003)	0.195*** (0.003)	0.203*** (0.003)	0.199*** (0.003)
Family type at age 15 (ref. lived with both parents)				
Single parent	-0.023*** (0.003)	-0.027*** (0.003)	-0.015*** (0.002)	-0.019*** (0.002)
Stepfamily	-0.029*** (0.003)	-0.030*** (0.003)	-0.026*** (0.003)	-0.027*** (0.003)
Native language (ref. Finnish)				
Swedish	-0.008 (0.005)	-0.006 (0.005)	0.009* (0.004)	0.011* (0.004)
Other	0.090*** (0.014)	0.089*** (0.014)	0.104*** (0.014)	0.102*** (0.014)
Migrant background (ref. native/mixed)				
Both parents immigrated	0.053*** (0.014)	0.046** (0.014)	0.040** (0.014)	0.034* (0.014)
GPA in lower secondary (decile rank, centered)	0.079*** (0.000)	0.079*** (0.000)	0.087*** (0.000)	0.087*** (0.000)
Region (ref. West)				
Helsinki/Uusimaa	0.061*** (0.003)	0.051*** (0.003)	0.066*** (0.003)	0.053*** (0.003)
South	0.019*** (0.003)	0.018*** (0.003)	0.005 (0.003)	0.004 (0.003)
North/East	-0.022*** (0.003)	-0.020*** (0.003)	-0.018*** (0.003)	-0.015*** (0.003)
Municipal urbanisation (ref. urban)				
Semi-urban	-0.019*** (0.003)	-0.011*** (0.003)	-0.019*** (0.003)	-0.011*** (0.003)
Rural	-0.032*** (0.003)	-0.016*** (0.003)	-0.025*** (0.003)	-0.011*** (0.003)
Driving time to nearest high school (log-transformed)		-0.026*** (0.002)		-0.035*** (0.002)
Driving time to nearest vocational school (log-transformed)		-0.001 (0.002)		0.007*** (0.002)
McFadden's pseudo-R ²	0.364	0.366	0.432	0.435
AIC	115,913.4	115,549.8	107,023.0	106,456.6
Observations	136,485	136,485	136,362	136,362

Notes: Standard errors in parentheses. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Appendix Table A.2

Comparison of goodness of fit indicators for conditional logit (CL) and mother logit models (MoL) of young people's first-ranked upper secondary alternative.

	Girls				Boys			
	CL model 1	CL model 2	MoL model 1	MoL model 2	CL model 1	CL model 2	MoL model 1	MoL model 2
LR test vs. CL Model 1 (p-value)	ref.	37.38 (0.015)	149.98 (0.000)	179.04 (0.000)	ref.	89.75 (0.000)	416.72 (0.000)	491.18 (0.000)
AIC	284,310.6	284,315.2	284,220.6	284,233.6	236,850.9	236,803.1	236,494.2	236,461.7
N (person-alternatives)	955,395	955,395	955,395	955,395	954,534	954,534	954,534	954,534
N (individuals)	136,485	136,485	136,485	136,485	136,362	136,362	136,362	136,362

Note: CoL = Conditional logit model. MoL = Mother logit model. Model 1: includes distance×alternative interaction. Model 2: includes distance×alternative×parental education -interaction. All models include controls for GPA in lower secondary school, family type, migration background, native language, NUTS2-region, urbanisation, field-specific sub-regional unemployment.

Appendix B. Supporting information

Supplementary data associated with this article can be found in the online version at [doi:10.1016/j.rssm.2023.100879](https://doi.org/10.1016/j.rssm.2023.100879). Code files used for data analysis are available at <https://doi.org/10.17605/osf.io/6ruxm>.

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