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Sibling influence in field of study choices

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ABSTRACT

This study evaluates sibling similarities in field of study choices after secondary education in the Netherlands. Based on social learning theory, it was argued that younger siblings follow their older sibling's field of study choices. This is more likely to occur when siblings differ more in age, older siblings are higher educated or when siblings are of the same sex. Data from the fifth wave of the Children of Immigrants Longitudinal Survey in the Netherlands were used. We analyzed 4556 children in 2923 families using conditional logit models. Congruent with the social learning theory, younger siblings follow their older sibling's fields of study, especially when they are of the same sex. There is no evidence that sibling similarities are dependent on differences in age or education level of the older sibling. They are also present irrespective of parental influence and independent of the specific field chosen by the older sibling. Siblings are therefore – next to parents – an important aspect of the home environment that shapes field of study choices.

1. Introduction

Choosing a field of study is an important decision for an individual's future career (Gerber & Cheung, 2008). One factor shown to have a particularly strong influence on an individual's educational career is the family (Eccles et al., 2011). While research has mainly focused on how parents influence their children's field of study (Davies & Guppy, 1997; Dryler, 1998; Van de Werfhorst & Luijkx, 2010; Van der Vleuten, Jaspers, Maas, & van der Lippe, 2018), there has been much less attention on another important part of the home environment: siblings. Given that older siblings will have chosen a field of study only a few years earlier, their knowledge about and experience in these educational fields make them potentially more important than parents. This study therefore focuses on how older siblings' field of study after secondary education is related to that of their younger sibling. We focus on older siblings because they are more likely to influence their younger siblings than vice versa (Rabe & Nicoletti, 2014). Moreover, for an individual's field of study choice to be affected by their siblings, these siblings must have gone through the process of selecting a field of study themselves at one point, which is more likely to have occurred if they are older.

Previous research shows that siblings influence each other with respect to many behaviors and attitudes (for an overview, see McHale, Updegraff, & Whiteman, 2012; Whiteman, McHale, & Soli, 2011; health risk behavior: D'Amico & Fromme, 1997; sexual behavior: Rowe & Gulley, 1992; smoking, drugs and alcohol use: Slomkowski, Rende, Novak, Lloyd-Richardson, & Niaura, 2005). It has only been more recently that studies began to focus on sibling associations in educational outcomes (school achievement: Adermon, 2013; Nicoletti & Rabe, 2019; educational attainment: Benin & Johnson, 1984; college choice: Goodman, Hurwitz, Smith, & Fox, 2016; high school graduation outcomes: Oettinger, 2000; years of schooling: Qureshi, 2011; school choice: Dustan, 2018). For example, educational achievement of older siblings has a positive effect on years of schooling (Qureshi, 2011) and on educational achievement of younger siblings (Oettinger, 2000). Younger siblings are more likely to choose the same college as their older sibling when siblings are closer in age (Goodman et al., 2016).

However, much less is known about the effect of siblings on field of study choices. Some studies focus on how the gender of older siblings affects younger siblings' field of study choices, without modelling effects of the older siblings own field of study choices (Anelli & Peri, 2015; Chen, 2016). Anelli and Peri (2015) show that in Italy male siblings are more likely to choose a gender stereotypical college major when they have a female sibling. Chen (2016) presents similar analyses for the USA, but does not find an influence of having an opposite gender sibling on choosing a male-dominated major.

As far as we know there is only one study examining how older sibling's field of study choice influences that of younger siblings.

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Joensen and Nielsen (2018) show a spillover effect from older to younger siblings with respect to choosing math-science in Danish high schools. They exploit exogenous variation in the psychological cost of making this choice for older siblings, which allows them to interpret this spillover as a causal effect. The effect is, however, only found for subgroups – especially closely spaced siblings and brother pairs – and disappears when a large number of control variables are entered into the models.

All in all, there is evidence in the literature that the presence of older siblings and the choices they make are important for the educational choices of younger siblings. There has been, however, very little research on the influence of older siblings' field of study choice on that of younger siblings, and the results are inconclusive. Our study aims to provide more evidence on this topic. Unfortunately, we cannot take advantage of an educational reform causing exogenous variation in field of study choices. Our approach is in this respect less strong than that of Joensen and Nielsen (2018). We can only investigate whether the sibling effect is spurious by taking into account a large number of characteristics that siblings have in common. But we add to the study of Joensen and Nielsen in several other aspects. We investigate a larger variety in fields of study (compared to math-science yes or no). We derive and test a number of hypotheses on heterogeneity in the sibling effect from social learning theory (Bandura, 1977) and study whether it matters when more than one older sibling chooses a certain field.

We use the fifth wave of the Children of Immigrants Longitudinal Study in the Netherlands (CILSNL) to test our hypotheses. The data were collected in 2015. The analytical sample consists of 4556 children in 2923 families in the Netherlands. The Netherlands is an interesting case study because, unlike most other countries, students do not wait to choose a field of study until they enter higher education (compare the USA, where students choose college majors; Legewie & DiPrete, 2014). Students in the Netherlands choose a field of study when they register for university, but also when they enroll in higher vocational educational (HBO) and in secondary vocational education (MBO). This paper therefore includes a wider group than only tertiary-level students. Additionally, these data allow us to shed light on the role of older siblings while controlling for many important family characteristics (e.g., parents' occupational field and socio-economic status). In contrast to the usual strategy of restricting the analyses to sibling pairs, we model how fields of study of all older siblings are associated with their younger sibling's field of study choices.

2. Theory

A set of theories (Bandura, 1977; Patterson, 1984) poses that social processes, such as modeling, reinforcements and opportunity provision, explain why siblings show similarities in behaviors and attitudes. In general, these social learning theories suggest that individuals learn new behaviors through the observation of others, so-called models. In the case of field of study choice, this new behavior not only refers to the content of the field of study (e.g. what it is like to work in a hospital), but also to what it takes to successfully complete it (e.g. with respect to personal characteristics, effort, or study material). In this way role models decrease the information costs and perceived risks of choosing a certain of field of study. One of the most important determinants of whether a model will attract another person's attention is the frequency of contact with the model. Because siblings (have) spend so much time with each other, they are potentially very important models.

A person is also more likely to become a model when he/she has attractive qualities, such as nurturance, power and mastery (Bandura, 1977). Especially older siblings tend to have these qualities. Older siblings are more likely to have more skills and knowledge, simply because they are older. They thus possess more power and mastery than their younger siblings. Older siblings are also often seen as nurturing because they provide directions, advice and support for younger siblings on how to act and behave (teaching role) and are more likely to take care of their younger siblings than vice versa (Azmitia & Hesser, 1993). This makes older siblings attractive role models for their younger siblings. If younger siblings see their older siblings as role models, this leads to sibling similarities in behavior or attitudes, which have been found in divergent behaviors and attitudes (McHale et al., 2012). When we focus on the few studies that looked at educational choices, sibling similarities have been found in school choice (Goodman et al., 2016) and math and science choices (Joensen & Nielsen, 2018). Because older siblings have recently gone through the process of choosing a field of study or deliberately choose not to select a field of study, we expect, based on social learning theory, that *younger siblings choose similar fields as their older siblings (H1)*.

According to social learning theory, siblings have relatively more power and mastery when they are older in age, which promotes modeling (Whiteman et al., 2011). This means that younger siblings are more likely to choose a similar field of study as their older siblings when they differ more in age. The same premise should hold when older siblings are higher educated. Higher educated older siblings have more power and mastery and are therefore more likely to promote modeling. Thus, higher educated older siblings are more likely to lead their younger sibling to a similar field than older siblings who have a lower or similar level of education than their younger sibling. We formulate the hypotheses that *younger siblings are more likely to choose fields similar to their older siblings if they differ more in age (H2) or are higher educated (H3)*.

The few studies examining sibling influence in educational choices have focused only on older sibling's age, not educational level, and these studies show no support for these hypothesized effects. Both Goodman et al. (USA: 2016) and Joensen and Nielsen (Denmark; 2018) found that sibling similarities in college choice or math and science choices, respectively, are more likely to occur when siblings differ less in age. Although we derived a hypothesis on a positive effect of age differences, there are plausible explanations for a negative effect as well. For example, if siblings are closer in age they may spend more time together. In that case a stronger influence can be expected (Whiteman et al., 2011).

Social learning theories also state that a person is more likely to imitate a model when he/she identifies more with the model. Identification occurs more often when siblings are of the same sex compared to when they are of the opposite sex (Rowe & Gulley, 1992; Whiteman & McHale, & Soli 2011). Same-sex older siblings are therefore more likely to lead their younger sibling to a similar field of study than opposite-sex siblings. In sum, we expect that *younger siblings are more likely to choose fields similar to their older siblings if they are of the same sex (H4)*

The few studies that focus on field of study-related choices show mixed results. Joensen and Nielsen (2018) found that sibling similarities in math and science are more likely to occur in brother pairs. Chen (2016) and Anelli and Peri (2015) study a slightly different issue. They compare families with same-sex siblings with families with opposite-sex siblings. Anelli and Peri (2015) found that the same-sex siblings are more likely to enter gender atypical college majors (for women this is defined as high-earning majors: economics/business, engineering and medicine) than opposite-sex siblings, who are more likely to enter gender typical fields. This suggests that opposite-sex siblings do not imitate each other, but specialize, reinforcing gender segregation. Chen (2016), however, did not find an effect of sex of the sibling on college major choice (defined as male dominated versus all other majors).

One could argue that there is also more identification between siblings of similar age and siblings attending the same level of education. This would be in line with Goodman et al. (2016) and Joensen and Nielsen (2018) who found more sibling similarity if the age difference is small. However, for the time being we assume that gender affects identification much more than age or educational level do, and that with respect to the latter two characteristics the power and mastery effects trump the identification effects.

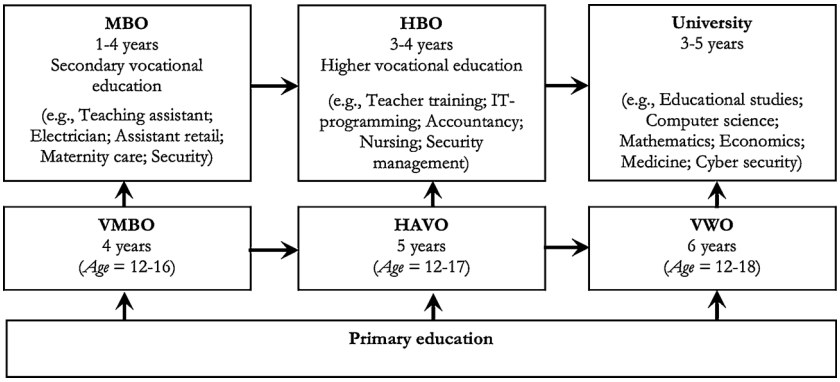

Fig. 1. The educational system in the Netherlands.

2.1. Parents

This paper focusses on the role of older siblings. It is not unlikely that younger siblings rely more on their older siblings than on their parents for guidance as older siblings might have more recent knowledge and experience in choosing an educational field (Melby, Conger, Fang, Wickrama, & Conger, 2008). However, research shows that parents also influence their children's field of study choices (Van de Werfhorst & Luijkx, 2010; Van der Vleuten et al., 2018). In order to identify the role of siblings, we extensively control for possible parental and other family influences (parents' highest education, mother's and father's occupational field, immigrant background, parents' school interest etc.).

2.2. The educational system of the Netherlands

The educational system of the Netherlands is displayed in Fig. 1. Depending on their grades, test results, and teachers' recommendation, students in the Netherlands can enter one of three levels of secondary education (at age 12) that differ in difficulty and length. The vocational level (VMBO; 4 years) prepares students for secondary vocational education (MBO). The general level (HAVO; 5 years) prepares students for universities of applied science (higher vocational education; HBO). Only the academic level (VWO; 6 years) prepares students for a research university. Dutch students choose a field of study when they enter secondary vocational education (at age 16), higher vocational education (at age 17) or university (at age 18). Although the timing of this choice differs across these three secondary educational levels, all fields of study are present at all levels. For example, at all levels one can choose health related fields (vocational level: maternity care; higher vocational education: nursing; university: medicine) or technical fields (vocational level: electrician; higher vocational education: IT-programming; university: computer science). More examples are displayed in Fig. 1. As shown in Table 1, not only are all fields available at all three levels, but they are also chosen by students to approximately the same extent. The only exception is the service field at the university level, which is chosen by only 1% of the students. A very unequal distribution of students over fields within levels is likely to depress sibling correlation in field of study for siblings who are on different levels. However, since this applies to only one field of study, this will not have a major influence on the results.

Table 1
Field of study choices by level of education.

Field of study	Secondary vocational education	Higher vocational education	University
Education, humanities, arts, and social sciences	458 22.17 %	449 27.87 %	279 31.74 %
Business and law	412 19.94 %	485 30.11 %	265 30.15 %
Science and engineering	343 16.60 %	239 14.84 %	138 15.70 %
Health, biology, agriculture, and veterinary	394 19.07 %	262 16.26 %	190 21.62 %
Services	459 22.22 %	176 10.92 %	7 0.80 %
Total	2066	1611	879

Source: Wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations.

3. Method

3.1. Data & sample

This paper uses data collected in the Netherlands as part of the Children of Immigrants Longitudinal Survey in the Netherlands (CILSNL; Jaspers & Van Tubergen, 2015). This project is a continuation of the Children of Immigrants Longitudinal Survey in Four European Countries (CILS4EU; Kalter et al., 2014, 2015, Kalter et al., 2016a, Kalter et al., 2016b), which aimed to explore the structural, cultural, and social integration of immigrant and non-immigrant children in the Netherlands, Germany, UK, and Sweden. The fifth wave, collected in 2015, was used to construct the variables, but some variables are complemented with information from waves 1 (2010/2011) and 2 (2011/2012) of the CILS4EU.

The Dutch sample in CILS4EU was based on a sample design stratified according to educational level and percentage of non-western immigrants in a school. Schools were selected with probability proportional to their size using the number of pupils at the relevant educational level. Additionally, schools with immigrant children were oversampled. The initial response rate of schools was 34.9 %. To increase the response rate, each non-responding school was replaced with a similar school (school response rate after replacement: 91.7 %). In total, 4963 respondents participated in wave 1 and an additional 2127 students participated in wave 2.[1] In waves 1 and 2, most respondents participated by filling in a self-completion questionnaire in their class at school. In wave 5, most respondents filled in an online questionnaire (approximately 85 %) after receiving an invitation by e-mail or in a letter sent to their home address. Those who did not respond were approached by phone and the survey was administered by phone (approximately 14 %). Lastly, students had the option to participate by completing a paper questionnaire if they preferred that over the online

[1] Classes changed considerably between wave 1 and wave 2 and because whole classes were surveyed, new students entered the sample.

version (approximately 1%). The response rate of wave 5 is 54.4 %, calculated as the ratio between the number of respondents who participated and the number of adolescents who had been approached and did not refuse participation before the start of wave 5.

In waves 1 or 2, respondents received a questionnaire for one of their parents to fill in at home. If parents did not respond, they received a shortened questionnaire in the third reminder and were eventually contacted by phone and asked to participate by completing this shortened questionnaire (parents' participation rate: wave 1: 74.7 %; wave 2: 42.8 %).

Of the total of 7090 students who entered the study in waves 1 or 2, 3759 respondents participated again in wave 5. Respondents were not included in our analyses when they filled in a shortened questionnaire (n = 71) or had missing values on key independent variables (n = 60). Moreover, we excluded respondents from families with twins (n = 180) and from families where no child has chosen a field of study or the fields of study of all children were unknown (n = 525; the majority of these respondents were only children who were either still in high school or started working directly after secondary education). This leads to a sample of 2923 respondents.

Sibling information was obtained from these respondents. They answered questions about their older brothers and/or sisters, up to a maximum of three older siblings. If they had more than one older sibling, they were instructed to start with the oldest. They were asked about their older siblings' age, level of education, sex, and field of study. Of the 2923 respondents, 1514 have no older siblings, 916 have one older sibling, 380 have two older siblings, and 113 have three older siblings. We include individuals with no older siblings in our analyses and treat them as individuals who cannot be influenced by older siblings (because they have none).[2] They are however important for estimating other effects, for example parental and family effects.

The next step involves restructuring the data so that all children within a family are cases. There are 4938 children (1514 + 2*916 + 3*380 + 4*113) in the restructured data, of which we exclude 382 who did not choose a field of study. For these children we cannot examine influences on their field of study choice (dependent variable). When we construct the independent variables, however, we do include information on these children. Note that we include the oldest sibling in the data and also treat them as individuals who cannot be influenced by their older sibling. The final sample consists of 4556 children from 2923 families.

3.2. Selectivity of the sample

Because we used the fifth wave of a longitudinal study, dropouts may have led to selectivity in our sample. Table 2 shows the percentages of students enrolled in a field of study in our analytical sample and the percentages based on national statistics (Statistics Netherlands, 2014, 2015) for different educational levels (secondary vocational education, higher vocational education, and university). We also show the composition of these groups with respect to gender and immigrant background because the original CILS4EU oversampled students with a non-western immigrant background. The national statistics represent students who were *enrolled in* a field of study in 2014/2015. To make the percentages of our analytical sample comparable to those reported in the national statistics, we include only the youngest child of the family because he/she was certainly enrolled in a field of study in 2014/2015 (n = 2923) whereas older siblings might have already graduated. Table 2 shows that students from secondary vocational education are overrepresented in our sample. This is probably the result of the original oversampling of schools with many immigrant children. This would be problematic if sibling associations differ between students taking vocational education, higher vocational education and university, but extra analyses showed that they do not.[3] Boys are underrepresented in our sample at all levels, but not to a large extent. Nevertheless, we will be more careful about generalizing our results to boys than to girls. The percentages of western and non-western students in our analytical sample are highly comparable to those derived from national statistics, but given that we started with an oversampling of non-western immigrants, the remaining non-western immigrants might also be a selective group. This is less problematic, however, because it is not our goal to generalize our findings to non-western immigrants, specifically.

Table 2
Percentage of students in fields of study in 2014/2015 in secondary vocational education, higher vocational education, and university, and composition by gender and immigrant background. A comparison between national statistics and our analytical sample (youngest child only; n = 2923).

	Secondary vocational education	Higher vocational education	University
National statistics			
Total	*40.65*	*37.74*	*21.61*
Male	51.88	48.65	48.61
Female	48.12	51.35	51.39
Dutch	73.52	73.50	69.00
Western	6.01	10.96	17.24
Non-western	20.47	15.54	13.76
A			
Total	*50.46*	*32.40*	*17.14*
Male	39.90	40.65	38.52
Female	60.20	59.35	61.48
Dutch	74.78	78.88	76.85
Western	5.22	5.39	7.39
Non-western	20.00	15.73	15.77

Source: Statistics Netherlands (2014, 2015) and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations.

In order to investigate a possible selection bias, we weighted our analytical sample based on national statistics from Statistics Netherlands (CBS), using the numbers of pupils with a Dutch, western and non-western background in 2015 in vocational education (MBO), higher vocational education (HBO) and university (WO) in the Netherlands (the numbers in Table 2). Weighting the data did not alter the results (see model 2, Table A5 in Appendix A). In this article we present results using unweighted data.

3.3. Measures

We aim to explain field of study choices of all children from a family. Our dependent variable *field of study choice* therefore refers to the field of study in which a child in a family is or was enrolled. The respondent was asked: "What is your field of study?". He/she was also asked: "Could you identify, as specifically as possible, the field of study of < name older sibling > ?". If their older siblings had already finished their education, respondents were instructed to fill in what their siblings had studied. The original response categories were coded into the three-digit International Standard Classification of Education (ISCED97; UNESCO, 2006). These were recoded into five field of study categories: 0 = Education, humanities, arts, and social sciences (including social services and excluding economics as a social science); 1 = Business and law (including economics); 2 = Science and engineering (including mathematics, computing, manufacturing, and construction); 3 = Health, biology, agriculture, and veterinary

[2] Excluding these individuals did not lead to different results as can be seen in model 1, Table A5 in Appendix A.

[3] The effect of older siblings' field of study for students on the MBO (log-odds: .45, p < .001) did not differ from those on the higher vocational education level (log-odds of this category compared to MBO: -.12, p = .273) or university level (log-odds of this category compared to MBO: .10, p = .472).

(including life sciences); 4 = Services (e.g., Security services & Personal services). Appendix A, Table A1 provides a detailed overview of the ISCED fields per category. Since we will apply conditional logistic regression models, the dependent variable will enter the analyses as a 0 (not chosen) versus 1 (chosen) dichotomous variable for each field of study (see the analyses section below).

3.4. Independent variables: older sibling's characteristics

The variables explained in this section are only for children who have one or more older sibling(s) (n = 1899). In the section on our analytical strategy, we will explain how we include children who do not have older siblings.

Field of study older sibling is coded the same as the dependent variable. Similarly to the dependent variable we create dichotomous variables that indicate for each field of study whether an older sibling chose it (1) or not (0).

Age difference reflects the age difference in years between siblings. For every child in the family, variables were created indicating the age differences between that child and every older sibling. The age differences between siblings range from 1 to 37 years, with an average of 3.24 years.

Differences in educational level with higher educated siblings: in the Netherlands the following levels can be distinguished: vocational track secondary education (VMBO) (0), general track secondary education (HAVO) (1), secondary vocational education (MBO) (2), academic track secondary education (VWO) (3), higher vocational education (HBO) (4) and university (5). Variables were created for every child in a family that reflect the educational level differences between that child and every older sibling. Since the hypothesis is about higher educated siblings, all negative educational level differences are given the -1. 75 % of the older siblings are at least as highly educated as the younger sibling. The mean of this variable is 0.34.

Same-sex siblings: variables were created for every child indicating whether each older sibling is of the same sex (1) or opposite sex (0). Of all children, 41 % have only opposite-sex older siblings, 42 % have only same-sex older siblings; 12 % have both an older brother and an older sister and 4% have both same-sex and opposite-sex siblings, but slightly more of either same-sex or opposite-sex siblings.

3.5. Controls

In all models we include dummy variables for fields of study. It could be that certain fields of study are more attractive to all siblings, for example because they provide good labor market opportunities or because they are typical female (and all siblings are women). Since only five broad fields of study are distinguished we cannot model the characteristics of these fields with variables, but including dummy variables for all fields will take the combined effects of all these characteristics into account. We also interact the dummy variables for fields of study with all other control variables. In that way we take into account that certain fields of study are more attractive for certain subgroups (e.g. more attractive for boys than for girls).

We control for characteristics of the child in the family whose field of study choice we are predicting. *Sex (girl = 1), birth year* and education level, coded as (2) *secondary vocational education*, (4) *higher vocational education,* and (5) *university*. Students in the Netherlands in secondary education can only enter a field of study at these levels. Therefore, this variable contains fewer categories compared to the variable indicating differences in educational levels between siblings.[4]

Mother's occupational field and *father's occupational field* are two variables that represent the occupational field in which mother or father is employed, respectively. Parents were asked about their current or most recent occupation and their main activities in this occupation, as well as that of their partner (if present). All occupations were coded according to the International Standard Classification of Occupations 2008 (ISCO08). These occupational fields were recoded into the same five fields as sibling's field of study. An overview of how the ISCO08 fields are recoded in these categories is available upon request. Missing values were replaced with information provided by the respondents, who also answered questions about their parents' main occupation in waves 1 or 2. However, respondents reported this information specifically for their biological parents. We therefore only replaced missing values when respondents indicated that they lived with their biological mother and/or father in waves 1 or 2 (n = 593 families).

Immigrant background indicates whether children, or one of their parents, were born outside western societies (2), were born in Western societies excluding the Netherlands (1), or were born in the Netherlands (0).[5]

We controlled for socio-economic status (SES) because students from higher SES families enter different fields of study than students from lower SES families (Van de Werfhorst, Sullivan, & Cheung, 2003). As an SES indicator, we used the *highest education level of the parents*. Parents were asked about their own and, if applicable, their partner's highest completed education level. The response categories were: primary education (1), secondary education (2), secondary vocational education (3), higher vocational education (4), or university (5). No education (0) was added when parents had not completed primary education. Parents' highest educational level was created by taking the highest level of education within a couple (or from only one parent if they did not have or live with a partner). Missing values for parents were replaced by their children's answers (n = 794 families).

To filter out family influence as much as possible, we performed additional analyses that control for more family effects. These analyses include variables that might affect field of study choices of children in a family, such as parents' school interest, parents' trust in school, home renting, neighborhood problems, parents' traditional gender ideology, parents' tolerance and parents' religion. An elaboration of how these variables could be related to children's field of study choices and how we constructed these variables can be found in appendix B. Descriptive statistics of all variables are presented in Table 3.

4. Analyses

The data were analyzed using conditional logistic regression models (Long & Freese, 2006). These models can be interpreted as a choice among a discrete set of options. The utility of an option – in this case field of study – depends on individual, sibling, and family-specific characteristics, and on a random distribution representing variables omitted from the utility specification. To estimate these models, we further restructured our data (see Table 4). For each individual in a family (N = 4556), we created five lines: one for each field of study that can be chosen. The dependent variable *field of study choice* takes the value (1) only for the field of study that was chosen and (0) for the other four fields.

The conditional logit models that we employ thus model the likelihood of choosing a certain field of study, depending on the fields of

[4] We also controlled for birth order of the siblings as well as for family structure (single parent families versus two-parent families), but this did not alter any of our results (see models 3 and 4, respectively, in Table A5 in Appendix A). We therefore left them out of the analyses.

[5] Based on the definition given by Statistics Netherlands (CBS) and consistent with how the CILS4EU sample was drawn, western societies are defined as Europe (excluding Turkey), North America, Oceania, Indonesia, and Japan (Indonesia and Japan are considered western based on their socio-cultural and socio-economic position. Indonesia was also part of the former Dutch East Indies). Non-western countries are Turkey, Morocco, Surinam, Dutch Antilles and Aruba, Africa, Asia (excluding Indonesia and Japan), and Latin America.

Table 3
Descriptive statistics.

	Mean	SD	Min	Max	N
Descriptives for fields of study					
Dependent variable					
Field of study choice					
Education, humanities, arts, and social sciences	0.26		0	1	4556
Business and law	0.26		0	1	4556
Science and engineering	0.16		0	1	4556
Health, biology, agriculture, and veterinary	0.19		0	1	4556
Services	0.14		0	1	4556
Independent variables					
Older sibling's field of study[a]					
Education, humanities, arts, and social sciences	0.34		0	3	1899
Business and law	0.30		0	3	1899
Science & engineering	0.20		0	3	1899
Health, biology, agriculture, and veterinary	0.24		0	3	1899
Services	0.16		0	3	1899
Descriptives for differences with older siblings					
Age difference[a]	3.24	2.93	1	37	1899
Difference in educational level[a]	0.34	1.10	−1	3	1899
Same-sex[a]	0.50		0	1	1899
Descriptives of control variables					
Sex (girl = 1)	0.57		0	1	4556
Birth year	1994	2.85	1971	1999	4556
Level of education					
Secondary vocational education and training	0.45		0	1	4556
Higher vocational education	0.35		0	1	4556
University	0.20		0	1	4556
Mother's occupational field[b,c]					
Education, humanities, arts, and social sciences	0.20		0	1	2864
Business and law	0.31		0	1	2864
Science and engineering	0.04		0	1	2864
Health, biology, agriculture, and veterinary	0.23		0	1	2864
Services	0.23		0	1	2864
Father's occupational field[b,c]					
Education, humanities, arts, and social sciences	0.07		0	1	2864
Business and law	0.36		0	1	2864
Science and engineering	0.34		0	1	2864
Health, biology, agriculture, and veterinary	0.10		0	1	2864
Services	0.14		0	1	2864
Immigrant background[b]					
Dutch	0.76		0	1	4556
Western immigrant	0.19		0	1	4556
Non-western immigrant	0.05		0	1	4556
Parents' highest educational level[b]	3.14	1.20	0	5	4556
Variables extra analyses					
Parents' school interest[b]	3.31	0.48	0	4	2299
Parents' trust in school[b]	2.72	0.49	0.33	4	2299
Home renting[b]	0.11		0	1	2299
Neighborhood problems[b]	0.22	0.52	0	4	2299
Parents' traditional gender ideology[b]	1.28	0.36	0.50	2	2299
Parents' tolerance[b]	1.71	0.68	0	4	2299
Parents religion[b]					
No religion	0.38		0	1	2299
Catholic	0.30		0	1	2299
Protestants	0.24		0	1	2299
Islam	0.03		0	1	2299
Other	0.04		0	1	2299

Source: Wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations.
Note: For categorical variables, proportions are given.
[a] Calculated only for children who have older siblings, thus excluding single child families and the oldest sibling.
[b] Wave 1 or wave 2 of Children of Immigrants Longitudinal Survey in Four European Countries, own calculations.
[c] For children who do not have missing values on mother's and father's occupational field.

study of the older siblings (much like mobility models used in stratification research: Hendrickx & Ganzeboom, 1998; Van de Werfhorst, De Graaf, & Kraaykamp, 2001). In this format, we also construct our final independent variables as we will explain using Table 4 in which we take one family as an example.

For our main independent variable *fields of study older siblings* (second last column of Table 4) we add per field of study the number of older siblings who have chosen that field. This variable ranges from 0, no older siblings chose this field, to 3, where all three older siblings have chosen this field. According to the hypotheses, having an older sibling with a certain field of study increases the likelihood that the younger sibling chooses this field as well. By counting the number of siblings that choose a certain field, we assume that all these siblings have a similar influence. Later we will test whether this assumption is correct. For people who have no older siblings (only child) or whose older sibling(s) have not chosen a field of study, this variable is 0 (no influence). This can be seen in Table 4 for the oldest sibling, child number 3 (Child ID = 3), where all scores are 0.

Moreover, we hypothesized that the effect of having a sibling who chose a certain field of study depends on age differences (H2), positive educational level differences (H3) and similarity in sex (H4). We therefore construct an interaction variable between fields of study of older siblings and the age difference with these siblings. If the older sibling is two years older and chooses Science and Engineering the interaction variable takes the value of 2*1 in the row for Science and Engineering and 2*0 in the rows for other fields of study (see the values for the older sibling of child number 2 (Child ID = 2). In the example in Table 4, the youngest child has two older siblings who both studied Science and Engineering. The first older sibling is one year older and the second older sibling is three years older. The interaction then becomes (1 + 3)*(1 + 1) = 4 (see final variables FoS older siblings*Age differences). If we include this variable in the model, it tells us whether younger siblings are more likely to choose fields similar to their older siblings when siblings differ more in age. We did this similarly for higher educated siblings and for whether siblings were of the same sex or opposite sex.[6]

Because our data are hierarchically structured – siblings are nested within families – we clustered standard errors to take into account the dependency of our data. Ideally, we would estimate conditional logit models with fixed effects for families. In that way we can exclude the possibility that similarity between siblings results from all things that siblings have in common instead of sibling influence. This is, however, impossible because families in general only have a few members. This creates overidentification when modeling the within family variance in field of study choices using the field of study choices of family members as predictors. Alternatively, we could estimate multinomial logistic regression with fixed family effects. This, however, would give us unreliable estimates due to the large number of parameters being estimated based on a limited sample. A conditional logit analysis allows us to reduce the number of parameters that need to be estimated and is therefore our preferred method of analysis. In order to minimize the possibility that we confuse sibling associations with effects of family variables, we estimate additional models that include a larger number of family characteristics.

A total of 6 models were estimated in our main analyses and the

[6] The main effect of these variables (e.g. whether siblings differ in age, education level and are of the same sex) are not included in the models. This is because conditional logit models can only estimate effects of variables that vary between the alternatives (i.e. fields of study choices). The variable 'field of study older sibling' varies between the alternatives, because (if there is one sibling) it is 1 for one of the five fields of study and 0 for the other four options. As a consequence, all interactions with this variable also differ between the alternatives. The variable 'same-sex siblings' itself only varies between sibling pairs and not between alternatives. It therefore would automatically be removed from the analyses (if we would have included it).

Table 4
Example of restructured data for conditional logit models.

Identifying information			Variables respondent		Variables older sibling 1			Variables older sibling 2			Variables older sibling(s) combined	
Child ID	Family ID	Field of study	FoS	Birth year	FoS	Birth year	Age dif	FoS	Birth year	Age dif	FoS older siblings	FoS older siblings * age dif
1	1	Education, humanities, arts, and social sciences	0	1996	0	1995	1	0	1993	3	0	0
1	1	Business and law	0	1996	0	1995	1	0	1993	3	0	0
1	1	Science and engineering	0	1996	1	1995	1	1	1993	3	2	4
1	1	Health, biology, agriculture, and veterinary	1	1996	0	1995	1	0	1993	3	0	0
1	1	Services	0	1996	0	1995	1	0	1993	3	0	0
2	1	Education, humanities, arts, and social sciences	0	1995	0	1993	2				0	0
2	1	Business and law	0	1995	0	1993	2				0	0
2	1	Science and engineering	1	1995	1	1993	2				1	2
2	1	Health, biology, agriculture, and veterinary	0	1995	0	1993	2				0	0
2	1	Services	0	1995	0	1993	2				0	0
3	1	Education, humanities, arts, and social sciences	0	1993							0	0
3	1	Business and law	0	1993							0	0
3	1	Science and engineering	1	1993							0	0
3	1	Health, biology, agriculture, and veterinary	0	1993							0	0
3	1	Services	0	1993							0	0

Note: FoS = field of study; age dif = age difference.

results can be found in Table 5. Model 1 tests whether younger siblings choose similar fields as their older siblings (H1). Models 2, 3 and 4 test whether younger siblings are more likely to choose fields similar to their older siblings if these differ more in age (H2), are higher educated (H3) or similar in sex (H4), respectively. Model 5 tests all effects at the same time. Lastly, we estimate model 6 that includes an interaction between older siblings' field of study and the number of older siblings to explore whether sibling associations depends on sibship size. Because parents' occupational fields had numerous missing values, we ran separate analyses in which we controlled for mother's and father's occupational field.[7] These results are shown in Table 6. Lastly, we conduct supplementary regressions that include more parental and family characteristics (Appendix A Table A4).[8] All results are shown in terms of log-odds. For practical reasons, we do not display the effects of the control variables. These can be found in Appendix A, Table A3 (but only for model 5 in Table 5, which is the full model, since the control variable effects for all other models and Table 6 were highly similar).

5. Results

Model 1 in Table 5 shows support for hypothesis 1. This model shows that for each older sibling who entered a certain field of study, the odds of the younger sibling choosing a similar field are more than 1.5 [exp(0.42 = 1.52)] times higher. This implies that the odds of younger siblings choosing a similar field as their older siblings are around 2.3 [exp((0.42*2) = 2.32)] or 3.5 [exp((0.42*3) = 3.53)] times higher if this younger sibling has two or three older siblings who have all chosen a similar field of study, respectively. Including field of study of older siblings as a categorical variable (see model 1, Table A2, Appendix A) tests our assumption whether all siblings have a similar influence (i.e., the effect of older siblings' field of study is linear). We find that having two older siblings who chose a certain field of study affects the odds of the younger sibling making a similar choice twice as strong as having one older sibling who chose a certain field. Compared to not having older siblings or having older siblings who have not chosen a field of study (the 0 category), having one sibling who entered a certain field increases the odds that younger siblings choose a similar field with 1.43 [exp(0.36) = 1.43)] and having two siblings who did so increases the odds with 2.91 [exp(1.07) = 2.91)]. These results indicates that each older sibling has a similar influence. There were only four families where all three older siblings choose similar fields, therefore we cannot provide a reliable estimate for this category.

The previous analyses showed that if older siblings choose a specific field of study, the younger sibling is more likely to choose this field of study as well. It could, however, be that younger siblings follow their older sibling when these chose a health related study, but not if they chose business and law (or vice versa). We therefore tested if the effect of older siblings' field of study depends on which fields older siblings had chosen by including a moderation between *field of study older siblings* and all fields of study categories (see model 2 in Table A2, Appendix A). In this additional model the effect of *field of study of the older sibling* now refers to older siblings who chose education, humanities, arts and social sciences. This effect was similar to the one reported in model 1 in Table 5 and the interactions were not significant. A joint

[7] Parents' occupational field had numerous missing values because not all parents participated and respondents often did not know their parents' occupation. Moreover, both parents had to be employed to be included in our analyses, which were based on list-wise deletion. That was not always the case, however.

[8] Our models in Table 5 contain many interactions, but we find no indication that this is problematic. Running all models in 5 again without control variables as well as including more control variables in Table A4 (where we estimate whether sibling effect is confounded by characteristics of the parents) shows that our results are robust and that all tables lead to the same conclusions as reported in this paper.

Table 5
Results of conditional logit models (log-odds) of how older siblings' characteristics influence younger sibling's field of study choice (N = 4556 in 2923 families).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Field of study older siblings	0.42***	0.44***	0.43***	0.29***	0.32***	0.55***
	(0.05)	(0.08)	(0.06)	(0.08)	(0.10)	(0.14)
× Age differences		−0.01			−0.00	
		(0.02)			(0.02)	
× Difference in educational level (positive only)			−0.02		−0.01	
			(0.04)		(0.04)	
× Same-sex siblings				0.22*	0.22*	
				(0.10)	(0.10)	
× Number of older siblings						
Having no older siblings (ref)						–
Having 1 older sibling						−0.20
						(0.15)
Having 2 older siblings						−0.07
						(0.16)
Having 3 older siblings						–
Log likelihood	−6514.69	−6514.63	−6514.62	−6512.33	−6512.24	−6513.48
Df	33	34	34	34	36	35
χ^2	1151.33	1152.93	1151.21	1172.60	1173.45	1153.89

Source: Waves 1 and 2 of Children of Immigrants Longitudinal Survey in Four European Countries and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.
Note: The analyses are controlled for field of study, birth year, sex (girl = 1), level of education, immigrant background and highest education level of parents. Estimating a linear regression model shows that the VIF's are all below 5, indicating that multicollinearity does not play a role.

Table 6
Results of conditional logit models (log-odds) of how older siblings' characteristics influence younger sibling's field of study, controlled for mother's and father's occupational field (n = 2864 in 1834 families).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Field of study older siblings	0.36***	0.32***	0.36***	0.16	0.11	0.34
	(0.06)	(0.09)	(0.07)	(0.10)	(0.13)	(0.19)
× Age differences		0.01			0.01	
		(0.02)			(0.02)	
× Difference in educational level (positive only)			−0.00		−0.00	
			(0.06)		(0.06)	
× Same-sex siblings				0.34**	0.35**	
				(0.13)	(0.13)	
× Number of older siblings						
No older sibling (ref)						–
Having 1 older sibling						−0.07
						(0.20)
Having 2 older siblings						0.14
						(0.22)
Having 3 older siblings						–
Mother's occupational field	0.18***	0.18***	0.18***	0.18***	0.18***	0.18***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Father's occupational field	0.55***	0.55***	0.55***	0.55***	0.55***	0.56***
	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)
Father's occupational field						
× Business and law	−0.29	−0.29	−0.29	−0.29	−0.29	−0.30
	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)	(0.20)
× Science and engineering	−0.13	−0.13	−0.13	−0.13	−0.13	−0.13
	(0.20)	(0.20)	(0.20)	(0.20)	(0.21)	(0.20)
× Health, biology, agriculture and veterinary	−0.07	−0.07	−0.07	−0.06	−0.07	−0.08
	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)
× Services	−0.62**	−0.62**	−0.62**	−0.63**	−0.63**	−0.63**
	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)
× Education, humanities, arts and social sciences (ref)	–	–	–	–	–	–
Log likelihood	−4046.28	−4046.15	−4046.28	−4042.72	−4042.55	−4045.08
Df	39	40	40	40	42	41
χ^2	761.82	761.49	762.82	781.23	781.32	761.62

Source: Waves 1 and 2 of Children of Immigrants Longitudinal Survey in Four European Countries and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.
Note: The analyses are controlled for field of study, birth year, sex (girl = 1), level of education, immigrant background and highest education level of parents.

Wald test shows that these interaction effects did not differ from 0 (Wald $\chi^2(4) = 6.07, p = .19$), meaning that the likelihood of younger siblings entering similar fields as their older siblings does not depend on which specific fields of study older siblings have chosen. In further models, we therefore focus on sibling similarities in fields of study and not on the specific fields that were chosen by older siblings.

In model 2 an interaction was added between *field of study of older siblings* and *age differences* to test whether younger siblings are more likely to choose fields similar to their older siblings if they differ more in age (H2). In case of no age differences, the odds of choosing a field similar to their older siblings are more than 1.55 times [exp(0.44 = 1.55] higher for every older sibling that has chosen this field. The interaction term with the age difference with the older siblings is, however, not significant. Moreover, the likelihood ratio test shows that model 2 is not a significant improvement over model 1 ($\chi^2(1) = 0.11, p = .73$). These results do not support hypothesis 2.

Model 3 includes the interaction between *field of study of older siblings* and whether or not *older siblings are higher educated*. It shows no support for hypothesis 3 stating that younger siblings are more likely to choose fields similar as their older siblings if the latter are higher educated. The interaction effect is not significant and a likelihood ratio test shows that model 3 is not a significant improvement over model 1 ($\chi^2(1) = 0.14, p = .71$).

Model 4 tests whether younger siblings are more likely to choose fields similar to their older siblings if they are of the same sex (H4). For each older opposite-sex sibling in a certain field, the odds of younger siblings choosing a similar field as this older sibling are 1.34 times [exp (0.29 = 1.34] higher. For each older same-sex sibling in a certain field, the odds of younger siblings to choose a similar field are 1.67 times [exp((0.29 + 0.22) = 1.67] higher. A likelihood ratio test shows that model 4 is a significant improvement over model 1 ($\chi^2(1) = 4.71$, $p < .05$). This confirms hypothesis 4.

Model 5 includes all variables and the effects are similar to models 1–4. Younger siblings choose similar fields as their older siblings, and this is more the case when siblings are of the same sex. Because the interpretation of interaction effects in logistic regression models is problematic (Ai & Norton, 2003; Mood, 2010), we also estimated linear probability models with fixed effects for individuals (see model 5 in Table A5 in Appendix A). An older sibling choosing a certain field of study increases the likelihood of the younger sibling choosing the same field by 6 percent. If the two siblings are of the same sex, then the increase is 13 percent.

Model 6 includes an interaction between *field of study of older siblings* and the *number of older siblings*. The way we model the effect of older sibling's field of study choice in model 1–5 assumes that each older sibling has an independent effect on the younger sibling, that these effects are of the same size, and that they are independent of family size. Whether the latter is true is tested in model 6. It could be expected that in small families the effect of each older child is stronger than in large families. This would be visible in model 6 as a significantly stronger effect of older siblings' field of study choice if there is only one older sibling compared to if there are two older siblings (there were not enough children with three older siblings to estimate that interaction). These effects are, however, both not significantly different from the main effect, and hence also not significantly different from each other. A likelihood ratio test also shows that model 6 is not a significant improvement over model 1 ($\chi^2(2) = 2.42, p = .30$). This means the effect of the field of study of the first and second older sibling do not depend on the number of older siblings in the family.

Table A3 in Appendix A shows the effect of the control variables. Younger cohorts are more likely to enter business and law or health, biology, agriculture and veterinary than education, humanities, arts, and social science. Students in higher vocational education are more likely than students in secondary vocational education to choose business and law over education, humanities, arts, and social science, and less likely than students in secondary vocational education to choose science and engineering; health, biology, agriculture and veterinary and services over education, humanities, arts, and social science. University students are less likely than students in secondary vocational education to study science and engineering and services than study education, humanities, arts, and social science. The results also show substantial gender differences in fields of study. Girls are less likely than boys to choose business and law, science and engineering, and services over education, humanities, arts, and social science. Gender differences are particularly pronounced when it comes to choosing science and engineering. Compared to education, humanities, arts, and social sciences, the odds of choosing science and engineering are more than 13 times higher [exp(2.59 = 13.33)] for boys compared to girls. Table A3 also shows that children from families with a higher educated background are less likely to choose business and law compared to education, humanities, arts and social sciences. Lastly, children with a western immigrant background are more likely to choose business and law over education, humanities, arts and social sciences. There are no differences between children with a non-western immigrant background and Dutch children.

5.1. Parents

To test whether sibling associations in field of study choices are not a result of parents' occupational field, we ran all analyses again including parents' occupational field. Results of these analyses can be found in Table 6. For fathers it was found that the likelihood of children to follow in their footsteps depend on *which* field they are in (based on model 1 Table 6: Wald $\chi^2(4) = 9.99, p < 0.05$). To allow his influence to be different across fields, we therefore include an interaction between father's field of study and the different fields. For mothers we found no such differential effects. Model 1 shows that the odds of a child choosing a field are around 1.20 [exp(0.18 = 1.20)] higher for the option chosen by their mother and 1.73 [exp(0.55 = 1.73)] higher for the option chosen by their father (for all options, except services). These effects are similar to the effect of the field of study of one older sibling (odds are exp(0.36) = 1.43 times higher), but smaller than when children have two older siblings in a certain field of study (odds are around exp(0.36*2) = 2.05 times higher). The conclusions with respect to age and education remain similar as in our main analyses, but when we take parental occupational field into account, only same-sex siblings, not opposite-sex siblings, are important for entering certain fields of study. This means that parents' occupational field influences sibling similarity in field of study choices, which explains the effect of opposite-sex siblings. For each older same-sex sibling in a certain field, the odds of younger siblings to choose similar fields are 1.65 times [exp ((0.16 + 0.34) = 1.65] higher. Overall, the fields of study of same-sex older siblings are important for younger siblings' field of study choices even after controlling for parents' occupational field. Moreover, having two same-sex siblings who chose a similar field might even be more important than mother's or father's influence.

In order to control for family effects more thoroughly, we also ran analyses that include more parental and family-related variables that possibly affect children's field of study choices (see Appendix A, Table A4). These analyses also include all previously mentioned control variables. Note that, as not all parents filled in the parental questionnaires, the number of children in these analyses is reduced (n = 2299 in 1485 families).

Table A4 in Appendix A shows that some of these characteristics matter for adolescents' field of study choices (e.g., parents' school interest, parents' trust in school, neighborhood problems). More important, however, is that younger siblings still choose similar fields as their older same-sex siblings. For each older same-sex sibling in a certain field, the odds of younger siblings to choose similar fields are 1.61 times [exp((0.16 + 0.32) = 1.61] higher. Same-sex siblings are therefore important for choosing fields of study, and the more so when there are more same-sex siblings in similar fields of study.

6. Conclusion and discussion

This study evaluated sibling similarities in field of study choices after secondary education in the Netherlands. The social learning theory argues that younger siblings follow their older sibling's field of study choices especially when siblings differ more in age, older siblings are higher educated or when siblings are of the same sex. We used the fifth wave of CILSNL data and analyzed 4556 children in 2923 families using conditional logit models.

Congruent with the social learning theory, we find that younger siblings follow their older siblings' fields of study. Whereas previous studies on sibling influence on educational and other outcomes focus on sibling pairs, and thus model the influence of one sibling only, we modeled the influence of up to three older siblings. There are no indications that sibling associations are stronger (or weaker) for the older sibling closest in age compared to the other older siblings. Also, the association with each older sibling is not weaker when more older siblings are present. This is important, because it means that studies focusing on sibling pairs tend to underestimate the total influence of siblings in families with more than two children. If children have two older siblings who chose a certain field of study, this increases their likelihood to also choose this field more than when they have only one older sibling in this field. This is an indication that the associations that we observe are likely (at least partly) causal. If the sibling associations were purely caused by unobserved characteristics making siblings similar, one would not expect that the effects of several siblings would be additive. Qualitative research examining college attendance, indicates that siblings can be important role models or information sources for entering fields of study (Ceja, 2006; Mwangi, 2015). Our results suggest that influence is more important than providing information. One older sibling is enough to provide information about a certain field of study, but two older siblings choosing the same field indicates a high agreement in the sibship that this is an interesting, worthwhile choice, also for the younger sibling.

When we control for the occupational fields of the parents, it appears that only same-sex older siblings are important for their younger sibling's field of study choice. This is in line with Goodman et al. (2016); USA) who found that same-sex siblings are more likely to attend a similar college than opposite-sex siblings. We find that the fields of study of a brother and sister are also more likely to be the same than the fields of study of an unrelated boy and girl, but that this is a consequence of parental influence and not of the brother following his sister's choice or vice versa. The parental influence mainly works through their occupational choices. Children are more likely to choose a field of study similar to the occupational field of their father or mother. It may also be that the children actually follow the field of study choice of their father of mother, which preceded their occupational choices. Other characteristics of the parents or family (e.g., parents' school interest, parents' trust in school, neighbourhood problems) have some effects on the choices of their children as well, but these characteristics do not explain a substantial part of the similarity between siblings.

From social learning theory it can be derived that siblings are more likely to be imitated when siblings differ more in age or are higher educated. Contrary to these predictions, previous studies found that sibling similarities in college choice (Goodman et al., 2016) or math and science choices (Joensen & Nielsen, 2018) are more likely to occur when siblings are more similar in age. This study finds no evidence that sibling similarities in field of study choices differ depending on age differences or education level of the older sibling. We conclude that there is no final answer yet to this question. Findings of different studies are contradictory. This may be the result of the fact that large differences in age and education on the one side indicate attractive qualities of the older sibling, but on the other side less strong identification of the younger sibling with the older one. It is notable that also parental influence on children's field of study choices has not been found to depend on power and mastery (indicated by parents' relative occupational status Dryler, 1998; Van der Vleuten et al., 2018).

We do not find any indications that the influence of older siblings depends on the specific field of study they have chosen, which have been found in Italy (like Anelli & Peri, 2015). Sibling similarities are present irrespective of the specific fields older siblings studied. This is an interesting finding in the light of gender segregation in field of study choices. If the oldest girl makes a gender atypical choice, younger sisters are likely to follow. Interventions meant to increase the number of individuals choosing gender atypical fields of study are therefore more effective if they target the oldest boy and girl in the family.

The main contribution of the paper to the literature is to show that sibling similarities in field of study choices are present even if we take into account many characteristics they have in common (i.e., family characteristics). However, we were unable to measure the underlying mechanisms that shape sibling similarities in field of study choices and therefore an important next step is to measure these explicitly. For example, previous studies have mentioned that de-identification mechanisms could be important for sibling influence (Festinger, 1954; Schachter, Shore, Feldman-Rotman, Marquis, & Campbell, 1976). These mechanisms predict that siblings select different niches (in our case fields of study) to emphasize dissimilarities between them as a way of avoiding sibling rivalry, envy, or resentment. They also predict that being similar – in terms of age, level of education or sex – would lead to an even greater desire to select a unique path, which should increase sibling dissimilarities in fields of study even further (Feinberg & Hetherington, 2000; Tesser, 1980). In all the analyses reported in this paper, we find strong support for sibling similarities in fields of study, indicating that mechanisms that lead to sibling similarities are more important than de-identification mechanisms. However, we cannot rule out that both social learning mechanisms and sibling de-identification mechanisms underlie sibling associations in fields of study. If both occur, effects might cancel each other out. This implies that we might actually underestimate the importance of social learning from siblings in field of study choices. An important task for future research is to disentangle these mechanisms by measuring them.

Similarly, we find that all same-sex siblings are equally influential for their younger sibling's field of study choice, but were unable to measure certain conditions under which sibling might have more influence. For example, future research could explore whether siblings have more influence when they live together or spend more time together as the opportunity to influence each other is larger in these cases. Another avenue would be to study if younger siblings are more influenced by the older siblings to whom he/she is closest, because sibling influence may be stronger when siblings have a close bond (Slomkowski et al., 2005; Whiteman & Christiansen, 2008).

Lastly, we should be cautious about interpreting our findings as sibling influence as we were unable to completely rule out potential non-causal explanations for sibling associations in field of study choices. For example, we cannot rule out that younger siblings also affect older siblings' field of study choices, which could especially be the case when siblings are more closely spaced. Hence, we often referred to sibling associations in this paper. Moreover, we could not use a quasi-experimental design, such as Joensen and Nielsen (2018), and estimating conditional logit models with fixed family effects is not possible. Therefore, we controlled for a large number of family characteristics. Parental fields of occupation indeed were a cause of similarity between siblings. However, all the other characteristics did not explain a discernable amount of sibling similarity. We are therefore confident that there exists a same-sex sibling influence. Nevertheless, we encourage future research exploring sibling influence on field of study choice to control for even more family and/or parental characteristics.

Overall, we conclude that younger siblings are more likely to choose fields similar to their older same-sex siblings' field of study. They do so more when more than one older (same-sex) sibling studied a similar field and irrespective of the specific fields chosen by the older siblings.

Siblings are therefore – next to parents – another important aspect of the home environment that shapes field of study choices.

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Appendix A

Table A1
ISCED fields coded in five categories.

ISCED97 fields	ISCED code	Label	Code
Education science	142	Education, humanities, arts & social sciences	0
Training for pre-school teachers	143	Education, humanities, arts & social sciences	0
Training for teachers at basic levels	144	Education, humanities, arts & social sciences	0
Training for teachers with subject specialization	145	Education, humanities, arts & social sciences	0
Training for teachers of vocational subjects	146	Education, humanities, arts & social sciences	0
Humanities & Arts	200	Education, humanities, arts & social sciences	0
Arts	210	Education, humanities, arts & social sciences	0
Fine arts	211	Education, humanities, arts & social sciences	0
Music & performing arts	212	Education, humanities, arts & social sciences	0
Audio-visual techniques & media production	213	Education, humanities, arts & social sciences	0
Design	214	Education, humanities, arts & social sciences	0
Craft skills	215	Education, humanities, arts & social sciences	0
Humanities	220	Education, humanities, arts & social sciences	0
Religion	221	Education, humanities, arts & social sciences	0
Foreign languages	222	Education, humanities, arts & social sciences	0
Mother tongue	223	Education, humanities, arts & social sciences	0
History & archaeology	225	Education, humanities, arts & social sciences	0
Philosophy & ethics	226	Education, humanities, arts & social sciences	0
Social & behavioral science	310	Education, humanities, arts & social sciences	0
Psychology	311	Education, humanities, arts & social sciences	0
Sociology & cultural studies	312	Education, humanities, arts & social sciences	0
Political science & civics	313	Education, humanities, arts & social sciences	0
Economics	314	Business & law	1
Journalism & information	320	Education, humanities, arts & social sciences	0
Journalism & reporting	321	Education, humanities, arts & social sciences	0
Library, information, archive	322	Education, humanities, arts & social sciences	0
Business & administration	340	Business & law	1
Wholesale & retail sales	341	Business & law	1
Marketing & advertising	342	Business & law	1
Finance, banking, insurance	343	Business & law	1
Accounting & taxation	344	Business & law	1
Management & administration	345	Business & law	1
Secretarial & office work	346	Business & law	1
Law	380	Business & law	1
Science, Mathematics & Computing	400	Science & engineering	2
Life science	420	Health, biology, agriculture & veterinary	3
Biology & biochemistry	421	Health, biology, agriculture & veterinary	3
Environmental science	422	Health, biology, agriculture & veterinary	3
Physical science	440	Science & engineering	2
Physics	441	Science & engineering	2
Chemistry	442	Science & engineering	2
Earth science	443	Science & engineering	2
Mathematics	461	Science & engineering	2
Statistics	462	Science & engineering	2
Computer science	481	Science & engineering	2
Computer use	482	Science & engineering	2
Engineering, Manufacturing & Construction	500	Science & engineering	2
Engineering & engineering trades	520	Science & engineering	2
Mechanics & metal work	521	Science & engineering	2
Electricity & energy	522	Science & engineering	2
Electronics & automation	523	Science & engineering	2
Chemical & process	524	Science & engineering	2
Motor vehicles, ships & aircraft	525	Science & engineering	2
Food processing	541	Science & engineering	2
Textiles, clothes, footwear, leather	542	Science & engineering	2
Materials (wood, paper, plastic, glass)	543	Science & engineering	2
Mining & extraction	544	Science & engineering	2
Architecture & town planning	581	Science & engineering	2
Building & civil engineering	582	Science & engineering	2
Agriculture, forestry & fishery	620	Health, biology, agriculture & veterinary	3
Crop & livestock production	621	Health, biology, agriculture & veterinary	3

(*continued on next page*)

Table A1 (*continued*)

ISCED97 fields	ISCED code	Label	Code
Horticulture	622	Health, biology, agriculture & veterinary	3
Forestry	623	Health, biology, agriculture & veterinary	3
Fisheries	624	Health, biology, agriculture & veterinary	3
Veterinary	640	Health, biology, agriculture & veterinary	3
Health & Welfare	700	Health, biology, agriculture & veterinary	3
Health	720	Health, biology, agriculture & veterinary	3
Medicine	721	Health, biology, agriculture & veterinary	3
Nursing & caring	723	Health, biology, agriculture & veterinary	3
Dental studies	724	Health, biology, agriculture & veterinary	3
Medical diagnostic & treatment technology	725	Health, biology, agriculture & veterinary	3
Therapy & rehabilitation	726	Health, biology, agriculture & veterinary	3
Pharmacy	727	Health, biology, agriculture & veterinary	3
Social services	760	Education, humanities, arts & social sciences	0
Child care & youth services	761	Education, humanities, arts & social sciences	0
Social work & counselling	762	Education, humanities, arts & social sciences	0
Hotel, restaurant & catering	811	Services	4
Travel, tourism & leisure	812	Services	4
Sports	813	Services	4
Domestic services	814	Services	4
Hair & beauty services	815	Services	4
Transport services	840	Services	4
Environmental protection	850	Services	4
Environmental protection technology	851	Services	4
Natural environments & wildlife	852	Services	4
Protection of persons & property	861	Services	4
Occupational health & safety	862	Services	4
Military & defense	863	Services	4

Table A2
Results of conditional logit models (log-odds) of how older siblings' characteristics influence younger sibling's field of study choice (N = 4556 in 2923 families). Results of adding older siblings' field of study as a categorical variable (model 1) and allowing the effect of older sibling's field of study to be different across fields of study (model 2).

	Model 1	Model 2
Field of study older sibling	0.36***	0.33***
	(0.06)	(0.09)
Field of study second older sibling	1.07***	
	(0.19)	
Field of study third older sibling	14.39	
	(0.51)	
No older sibling/no siblings whi has chosen a field of study (ref)	–	
Field of study older sibling		
× Business and law		0.10
		(0.14)
× Science and engineering		0.25
		(0.16)
× Health, biology, agriculture and veterinary		0.24
		(0.16)
× Services		−0.13
		(0.18)
× Education, humanities, arts and social sciences (ref)		–
Log likelihood	−6511.49	−6511.73
Df	35	37
χ^2	1966.67	1163.76

Source: Waves 1 and 2 of Children of Immigrants Longitudinal Survey in Four European Countries and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. *Note:* The analyses are controlled for field of study, birth year, sex (girl = 1), level of education, immigrant background and highest education level of parents.

Table A3
Results of conditional logit models (log-odds) of the control variables (N = 4556).

Controls	Full model (model 5)
Birth year	
× Business and law	0.05**
	(0.01)
× Science and engineering	0.02
	(0.02)
× Health, biology, agriculture, and veterinary	0.04*
	(0.02)
× Services	0.02
	(0.02)
× Education, humanities, arts, and social sciences (ref)	–
Secondary vocational education (ref)	–
Higher vocational education	
× Business and law	0.29**
	(0.10)
× Science and engineering	−0.33**
	(0.12)
× Health, biology, agriculture, and veterinary	−0.34**
	(0.11)
× Services	−0.93***
	(0.11)
× Education, humanities, arts, and social sciences (ref)	–
University	
× Business and law	0.21
	(0.12)
× Science and engineering	−0.43**
	(0.15)
× Health, biology, agriculture, and veterinary	−0.13
	(0.13)
× Services	−3.68***
	(0.39)
× Education, humanities, arts, and social sciences (ref)	–
Girl	
× Business and law	−1.26***
	(0.09)
× Science and engineering	−2.59***
	(0.12)
× Health, biology, agriculture, and veterinary	−0.05
	(0.11)
× Services	−1.04***
	(0.11)
× Education, humanities, arts, and social sciences (ref)	–
Highest education level of parents	
× Business and law	−0.10**
	(0.04)
× Science and engineering	−0.02
	(0.05)
× Health, biology, agriculture, and veterinary	−0.07
	(0.04)
× Services	−0.01
	(0.04)
× Education, humanities, arts, and social sciences (ref)	–
Dutch (ref)	–
Western-immigrant	
× Business and law	0.80***
	(0.11)
× Science and engineering	−0.03
	(0.15)
× Health, biology, agriculture, and veterinary	0.08
	(0.13)
× Services	−0.13
	(0.15)
× Education, humanities, arts, and social sciences (ref)	–
Non-western immigrant	
× Business and law	−0.11
	(0.19)

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Table A3 (*continued*)

Controls	Full model (model 5)
× Science and engineering	−0.26
	(0.23)
× Health, biology, agriculture, and veterinary	−0.28
	(0.18)
× Services	0.12
	(0.20)
× Education, humanities, arts, and social sciences (ref)	–
Business and law	−94.69**
	(29.88)
Science and engineering	−41.12
	(38.22)
Health, biology, agriculture, and veterinary	−73.84*
	(31.49)
Services	−33.16
	(35.63)
Education, humanities, arts, and social sciences (ref)	–
Log likelihood	−6513.48
Df	35
χ^2	1153.89

Source: Waves 1 and 2 of Children of Immigrants Longitudinal Survey in Four European Countries and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations.
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Table A4
Results of conditional logit models (log-odds) of how older siblings' characteristics influence younger sibling's field of study, controlled for many parental characteristics (n = 2299 in 1485 families).

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Field of study older siblings	0.35***	0.30**	0.35***	0.16	0.12	0.31
	(0.07)	(0.10)	(0.08)	(0.11)	(0.14)	(0.21)
Age differences		0.01			0.01	
		(0.02)			(0.02)	
Difference in educational level (positive only)			−0.00		0.00	
			(0.06)		(0.06)	
Same-sex siblings				0.32*	0.32*	
				(0.15)	(0.15)	
Having 1 older sibling						−0.11
						(0.22)
Having 2 older sibling						0.26
						(0.24)
Having 3 older sibling						–
Having no older sibling						–
Mother's occupational field	0.19***	0.19***	0.19***	0.19***	0.19***	0.20***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)
Father's occupational field	0.51**	0.51**	0.51**	0.51**	0.51**	0.51**
	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)
Father's occupational field						
× Business and law	−0.28	−0.28	−0.28	−0.28	−0.27	−0.28
	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)
× Science and engineering	−0.14	−0.14	−0.14	−0.15	−0.14	−0.15
	(0.22)	(0.23)	(0.22)	(0.23)	(0.23)	(0.23)
× Health, biology, agriculture and veterinary	−0.04	−0.04	−0.04	−0.04	−0.04	−0.05
	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)
Services	−0.54*	−0.54*	−0.54*	−0.54*	−0.54*	−0.55*
	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)	(0.27)
× Education, humanities, arts and social sciences (ref)	–	–	–	–	–	–
Parents' school interest						
× Business and law (1)	0.13	0.13	0.13	0.12	0.12	0.14
	(0.13)	(0.13)	(0.13)	(0.14)	(0.14)	(0.13)
× Science and engineering (2)	−0.01	−0.01	−0.01	−0.00	−0.00	−0.00
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)
× Health, biology, agriculture and veterinary (3)	0.04	0.04	0.04	0.04	0.04	0.05
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
× Services (4)	0.35*	0.35*	0.35*	0.36*	0.36*	0.36*
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)

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Table A4 (*continued*)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
× Education, humanities, arts and social sciences (ref)	–	–	–	–	–	–
Parents' trust in school						
× Business and law (1)	−0.24	−0.24	−0.24	−0.25	−0.25	−0.24
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
× Science and engineering (2)	−0.29*	−0.29*	−0.29*	−0.30*	−0.30*	−0.29*
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
× Health, biology, agriculture and veterinary (3)	0.02	0.02	0.02	0.02	0.02	0.03
	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)	(0.13)
× Services (4)	−0.27	−0.27	−0.27	−0.27	−0.27	−0.26
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
× Education, humanities, arts and social sciences (ref)	–	–	–	–	–	–
Own a home (ref)	–	–	–	–	–	–
Rent a home						
× Business and law (1)	0.27	0.27	0.27	0.26	0.26	0.28
	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)
× Science and engineering (2)	0.28	0.28	0.28	0.28	0.28	0.28
	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)
× Health, biology, agriculture and veterinary (3)	0.29	0.28	0.29	0.28	0.28	0.28
	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)	(0.23)
× Services (4)	0.22	0.22	0.22	0.21	0.21	0.23
	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)	(0.25)
× Education, humanities, arts and social sciences (ref)	–	–	–	–	–	–
Neighborhood problems						
× Business and law (1)	−0.30**	−0.30**	−0.30**	−0.29**	−0.29**	−0.30**
	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)	(0.11)
× Science and engineering (2)	−0.28*	−0.28*	−0.28*	−0.28*	−0.28*	−0.28*
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
× Health, biology, agriculture and veterinary (3)	−0.20	−0.20	−0.20	−0.20	−0.20	−0.20
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
× Services (4)	−0.35*	−0.35*	−0.35*	−0.35*	−0.35*	−0.35**
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
× Education, humanities, arts and social sciences (ref)	–	–	–	–	–	–
Parents' traditional gender ideology						
× Business and law (1)	0.12	0.12	0.12	0.13	0.13	0.12
	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)
× Science and engineering (2)	−0.06	−0.06	−0.06	−0.06	−0.06	−0.06
	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)
× Health, biology, agriculture and veterinary (3)	0.13	0.13	0.13	0.13	0.13	0.13
	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)
× Services (4)	0.17	0.17	0.17	0.18	0.18	0.17
	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)	(0.22)
× Education, humanities, arts and social sciences (ref)	–	–	–	–	–	–
Parents' tolerance						
× Business and law (1)	0.08	0.08	0.08	0.08	0.08	0.08
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
× Science and engineering (2)	0.10	0.10	0.10	0.11	0.11	0.10
	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)	(0.14)
× Health, biology, agriculture and veterinary (3)	0.01	0.01	0.01	0.01	0.02	0.01
	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)	(0.12)
× Services (4)	0.27	0.27	0.27	0.27	0.27	0.27
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
× Education, humanities, arts and social sciences (ref)	–	–	–	–	–	–
Parents non-religious (ref)	–	–	–	–	–	–
Catholic						
× Business and law (1)	0.16	0.16	0.16	0.17	0.17	0.16
	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)	(0.15)
× Science and engineering (2)	−0.02	−0.02	−0.02	−0.02	−0.02	−0.03
	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)	(0.19)
× Health, biology, agriculture and veterinary (3)	−0.22	−0.21	−0.22	−0.20	−0.19	−0.22
	(0.47)	(0.47)	(0.47)	(0.47)	(0.47)	(0.47)
× Services (4)	0.25	0.25	0.25	0.25	0.25	0.23
	(0.34)	(0.34)	(0.34)	(0.34)	(0.34)	(0.34)
× Education, humanities, arts and social sciences (ref)	–	–	–	–	–	–
Protestant						
× Business and law (1)	0.12	0.13	0.12	0.13	0.13	0.13
	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)	(0.17)

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Table A4 (*continued*)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
× Science and engineering (2)	−0.02	−0.02	−0.02	−0.02	−0.02	−0.02
	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)
× Health, biology, agriculture and veterinary (3)	0.19	0.19	0.19	0.20	0.20	0.19
	(0.61)	(0.61)	(0.61)	(0.61)	(0.61)	(0.61)
× Services (4)	−0.02	−0.02	−0.02	−0.02	−0.02	−0.04
	(0.45)	(0.45)	(0.45)	(0.45)	(0.45)	(0.45)
× Education, humanities, arts and social sciences (ref)	–	–	–	–	–	–
Islamic						
× Business and law (1)	0.10	0.10	0.10	0.10	0.10	0.10
	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)	(0.16)
× Science and engineering (2)	0.04	0.05	0.04	0.05	0.05	0.05
	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)
× Health, biology, agriculture and veterinary (3)	−0.22	−0.22	−0.22	−0.20	−0.20	−0.22
	(0.51)	(0.51)	(0.51)	(0.51)	(0.51)	(0.51)
× Services (4)	0.11	0.11	0.11	0.11	0.11	0.10
	(0.36)	(0.36)	(0.36)	(0.36)	(0.36)	(0.36)
× Education, humanities, arts and social sciences (ref)	–	–	–	–	–	–
Other religion						
× Business and law (1)	−0.10	−0.10	−0.10	−0.10	−0.10	−0.10
	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)	(0.18)
× Science and engineering (2)	−0.14	−0.13	−0.14	−0.13	−0.13	−0.13
	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)
× Health, biology, agriculture and veterinary (3)	−0.87	−0.87	−0.87	−0.86	−0.86	−0.88
	(0.60)	(0.60)	(0.60)	(0.60)	(0.60)	(0.60)
× Services (4)	0.14	0.14	0.14	0.14	0.14	0.13
	(0.38)	(0.38)	(0.38)	(0.39)	(0.39)	(0.39)
× Education, humanities, arts and social sciences (ref)	–	–	–	–	–	–
Log lik.	−3237.70	−3237.56	−3237.69	−3235.26	−3235.13	−3235.01
df	79	80	80	80	82	81
Chi-squared	635.38	635.47	636.52	651.66	652.23	637.71

Source: Waves 1 and 2 of Children of Immigrants Longitudinal Survey in Four European Countries and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations. *p < 0.05, **p < 0.01, ***p < 0.001.
Note: The analyses are controlled for field of study, birth year, sex (girl = 1), level of education, immigrant background and highest education level of parents. Estimating a linear regression model shows that the VIF's are all below 5, indicating that multicollinearity does not play a role.

Table A5
Results of conditional logit models (log-odds) of how older siblings' characteristics influence younger sibling's field of study choice. Analyses without singletons (model 1), weighted (model 2), controlled for birth order (model 3), controlled for family structure (model 4). Model 5 is a linear probability model with individual fixed effects.

	Model 1	Model 2	Model 3	Model 4	Model 5
Field of study older siblings	0.31**	0.27**	0.32***	0.27**	0.06**
	(0.10)	(0.10)	(0.10)	(0.10)	(0.02)
× Age differences	−0.01	−0.00	−0.01	−0.00	−0.00
	(0.02)	(0.02)	(0.02)	(0.02)	(0.00)
× Difference in educational level (positive only)	−0.00	−0.01	−0.01	−0.02	−0.00
	(0.04)	(0.04)	(0.04)	(0.04)	(0.01)
× Same-sex siblings	0.22*	0.23*	0.21*	0.24*	0.07**
	(0.10)	(0.10)	(0.10)	(0.10)	(0.02)
First born/singletons (ref)			–		
Second born					
× Business and law (1)			0.18		
			(0.10)		
× Science and engineering (2)			0.16		
			(0.12)		
× Health, biology, agriculture and veterinary (3)			0.12		
			(0.11)		
× Services (4)			0.20		
			(0.12)		
× Education, humanities, arts and social sciences (ref)			–		
Third born					
× Business and law (1)			−0.02		
			(0.15)		
× Science and engineering (2)			0.01		
			(0.18)		
× Health, biology, agriculture and veterinary (3)			0.17		
			(0.15)		

(*continued on next page*)

Table A5 (*continued*)

	Model 1	Model 2	Model 3	Model 4	Model 5
× Services (4)			−0.09		
			(0.18)		
× Education, humanities, arts and social sciences (ref)			–		
Fourth born					
× Business and law (1)			−0.48		
			(0.29)		
× Science and engineering (2)			−0.13		
			(0.35)		
× Health, biology, agriculture and veterinary (3)			0.09		
			(0.28)		
× Services (4)			−0.29		
			(0.35)		
× Education, humanities, arts and social sciences (ref)			–		
Two-parent families (ref)				–	
One-parent families					
× Business and law (1)				−0.26	
				(0.14)	
× Science and engineering (2)				−0.37*	
				(0.17)	
× Health, biology, agriculture and veterinary (3)				−0.27	
				(0.15)	
× Services (4)				−0.27	
				(0.16)	
× Education, humanities, arts and social sciences (ref)				–	
Constant					0.25***
					(0.01)
$N_{Siblings}$	3042	4456	4456	4456	4456
$N_{families}$	1409	2923	2923	2923	2923
Log likelihood	−4316.14	−6526.91	−6505.93	−6140.91	−10475.14
Df	36	36	48	40	35
χ^2	840.09	1138.39	1198.35	1118.03	–

Source: Waves 1 and 2 of Children of Immigrants Longitudinal Survey in Four European Countries and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations. *p < 0.05, **p < 0.01, ***p < 0.001.
Note: The analyses are controlled for field of study, birth year, sex (girl = 1), level of education, immigrant background and highest education level of parents.

Appendix B. Reasoning behind and operationalization of family effects

Parents' school interest indicates parents' interest in their child's performance in school. This may be associated with parents expecting their children not only to do good in school, but also choose certain (prestigious) fields of study. This scale was created by averaging three items that ranged from not interested (0) to very interested (5; α = .76). The items are "I show interest in my child's grades and achievement in school", "I encourage my child to work hard in school"), and "I tell my child I am proud when he/she does well in school". A higher score indicates more interest.

Parents' trust in school indicates how much trust parents have in their children's school. If parents have less trust in the school they might interfere more with their children's educational choice. As a result, the choices of their children may be more similar. A scale was created by averaging 6 items (α = .81). The items are 1) "*I trust the school to give my child good education"; 2)"I feel I can always talk to school if problems arise"; 3) "I have confidence in the teachers at my child's school"; 4)"I would like my child to attend another school";* 5) "*I think the school cares about the future of my child"; 6) "I believe the school could do more for my child"* (α = .81). The answer categories range for strongly agree (0) to strongly disagree (4). Items 1, 2, 3 and 5 were reversed so that a higher score indicates more trust in school.

Home renting indicates whether parents rent (1) or own a home (0). Parents who own a home probably have more resources to support the educational development of their child (e.g., extra lessons, better study materials), which might lead to better possibilities for each child to choose the field of education it likes most (and thus less similarity between children).

Neighborhood problems indicates no problems (0) to a lot of problems in the neighborhood (4). More problems in the neighborhood can also be an indication of parents' resources as these neighborhoods are less attractive to live in and therefore cheaper. Poverty may restrict the educational choices of all the children in similar ways. The variable is a sum score of four yes (1) and no (0) items indicating whether the neighborhood has poor housing, noisy neighbors, crime, and whether parents have fear of going out at night.

Parents' traditional gender ideology ranges from non-traditional (0) to very traditional (2). Parents with more traditional ideas on how men and women should behave might also think that some fields of study are not for their son (e.g., nurse) or daughter (e.g., plumber). If students take over these ideologies and act conform them, then this might influence their educational choices. It will probably make the choices of same-sex children more alike and choices of opposite-sex children more different. A scale is created by averaging four items about whether the man, woman or both sexes should be responsible for cooking, cleaning, earning money, and childcare (α = .78).

Parents' tolerance ranges from intolerant (0) to tolerant (4). More tolerant parents might give their children more freedom to choose any field of study. It is created by averaging four items about tolerance towards homosexuality, abortion, divorce and couples living together without being married (α = .80).

Parents' religion indicates whether parents were non-religious (0), catholic (1), protestant (2), Islamic (3) or had another religion (4). Next to the fact that being religious can also be an indication of how traditional parents are, different religions might also be associated with different ideas on what is an appropriate field of study choice for their children. For example, a hairdresser is considered a masculine occupation in most Islamic countries, whereas it is considered a feminine occupation in most western countries.

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