Gendered Choices

Fields of study of adolescents in the Netherlands

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Gendered Choices

Fields of study of adolescents in the Netherlands

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(met een samenvatting in het Nederlands)

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Contents

Chapter 1

Synthesis: Explaining boys' and girls' field of study choices*

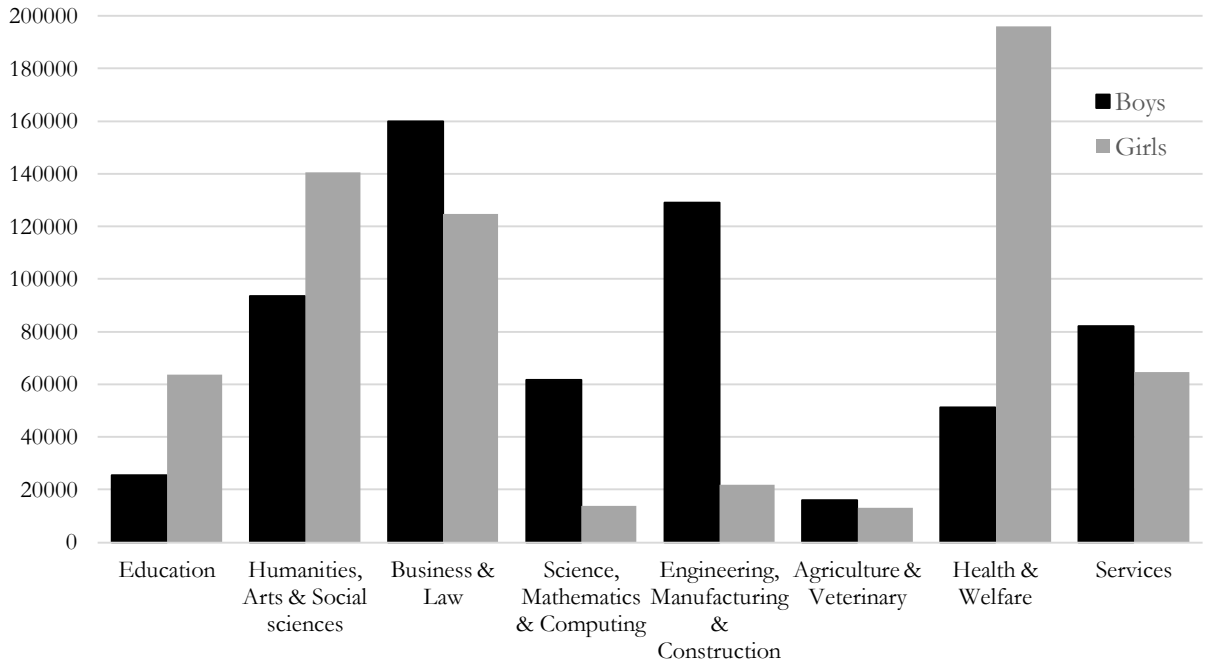
* This chapter tremendously benefited from the feedback of Eva Jaspers, Ineke Maas, Tanja van der Lippe, Bas Hofstra, and Lotte van der Vleuten.

1.1 Introduction

Choosing a field of study is an important decision in determining future educational trajectories and occupations, and we know that boys and girls make different field of study choices (Eccles, 2011). Girls are underrepresented in gender stereotypical masculine fields like science, technology, engineering and mathematics (STEM) (Mann & DiPrete, 2013; Xie, Fang, & Shauman, 2015). Girls refrain from choosing these fields despite a tremendous increase of girls in higher education over the last few decades and numerous policy efforts aimed to increase girls participation in STEM fields (Barone, 2011; Booy, Jansen, Joukes, & Van Schaik, 2012; Charles & Bradley, 2009; DiPrete & Buchmann, 2013; Mann & DiPrete, 2013). The tendency of girls to avoid or drop out of STEM fields throughout their educational career is referred to in the literature as the "leaky pipeline" (Alper, 1993; Mann & DiPrete, 2013; Xie & Shauman, 2003). Whereas previous research has mainly focused on girls' underrepresentation in STEM fields, much less research has focused on boys' underrepresentation in gender stereotypical feminine fields like education, arts, humanities, (OECD, 2009: table A3.6) or health-related fields (Gerber & Cheung, 2008; Sikora & Pokropek, 2012).

These gender differentials are present in a huge variety of industrialized countries (Mann & DiPrete, 2013; Sikora & Pokropek, 2012), including the Netherlands, which is the focus of this dissertation. Figure 1.1 shows the distribution of boys and girls in fields of study after secondary education in the Netherlands in 2014/2015 (Statistics Netherlands, 2014, 2015). The figure includes students in secondary vocational education, higher vocational education and university as Dutch students choose a field of study at different educational levels. We clearly see that girls are underrepresented in the STEM-related fields like engineering, manufacturing and construction as well as science, mathematics and computing. Girls are also underrepresented in business and law and, to a lesser extent, services. Boys are clearly underrepresented in fields like health and welfare as well as education, humanities, arts, and social sciences. Agriculture and veterinary are the least popular fields and seem to attract similar numbers of boys and girls.

The underrepresentation of girls in gender stereotypical masculine fields and boys in gender stereotypical feminine fields is undesirable for many reasons. First, male-dominated fields like computing and engineering offer more salary and higher occupational status compared to female-dominated fields like arts, education and humanities (Altonji, Arcidiacono, & Maurel, 2016; Webber, 2014). With girls not choosing STEM-related fields, many girls miss the high earning opportunities and professional positions that these careers offer, which sustains gender inequality in salary and women's underrepresentation in higher status occupations. Given that job opportunities in STEM fields continue to grow more than in any other industry (Schwab & Samans, 2016), getting more women in STEM fields would benefit women's earnings and decrease gender inequality in job status. Girls are also underrepresented in fields like business and law that also lead to high income jobs and higher status occupations, but given that STEM fields are more gender-segregated and offer more opportunity for women given their rapid growth, much more research focused on girls' underrepresentation in STEM fields.



Source: Statistics Netherlands (Statistics Netherlands, 2014, 2015)[1].

Figure 1.1 Distribution of boys and girls in fields of study after secondary education (secondary vocational education, higher vocational education and university) in 2014/2015 in the Netherlands.

Furthermore, society misses out on talented girls in these gender stereotypical masculine fields of study that are considered to be critical for economic innovation and productivity. Research has consistently shown that women have equally good – or even better – STEM-related abilities (Jagacinski, 2013; Riegle-Crumb, King, Grodsky, & Muller, 2012; Voyer & Voyer, 2014). Women's untapped human capital could therefore greatly contribute to the skills and expertise needed in the economy of tomorrow (Aguirre, Hoteit, Rupp, & Sabbagh, 2012; Corbett & Hill, 2015; Hill, Corbett, & Rose, 2010). Moreover, increasing women's participation in STEM-related fields leads to scientific and technological products, services and solutions that represent all – male and female – users. If society fails to attract and retain women in gender stereotypical masculine fields, it might overlook the needs and desires of half the population in future technical designs and products (Hill et al., 2010).

The underrepresentation of boys in feminine fields is undesirable for similar reasons, but has received much less attention. For example, even though it is true that – overall – male-dominated fields are better remunerated than female-dominated fields, there are many great career paths in female-dominated sectors that boys now miss out on. Not just in terms of earnings (e.g., pediatrician, physician assistant), but also paths that would complement boys' preferences and talents. Boys now often shy away from feminine fields because these are viewed as moving down the ladder (Perra & Ruspini, 2013), whereas the opposite is true for women entering masculine fields. A better understanding of (cross-)gendered choices might therefore not only lower the barrier for women to enter masculine fields, but also lower the barrier for men to enter gender stereotypical feminine fields. Moreover, with boys not choosing female-dominated fields, society

[1] The numbers from secondary vocational education are not available online. We requested them from Statistics Netherlands. They are available upon request from the author.

might miss out on talented men who would do well in these fields. Just as male-dominated fields would thrive from more females, female-dominated fields (like health or education) could thrive with male perspectives and access to male talent.

A last reason why gender imbalances in fields of study are undesirable is because the overrepresentation of either men or women in educational fields can reinforce children's ideas about what is considered typical "feminine" and "masculine" behavior, which in turn underpins traditional male or female gender role patterns and increases gender inequality (Geerdink, Bergen, & Dekkers, 2011).

In order to decrease gender segregation in educational fields, we need a better understanding of the mechanisms underlying adolescents' field of study choices and study how these might differ between boys and girls. The main research question this dissertation therefore aims to answer is:

How can we explain adolescents' field of study choices and which mechanisms lead boys and girls to different fields of study?

In order to explain gender differences in fields of study, research has mainly focused on gender differences in ability or achievement. Boys were thought to be better at math, spatial or non-verbal activities and girls at verbal reasoning and writing. However, ample studies concluded that gender differences in field of study choices cannot be explained by differences in ability or achievement (Ceci & Williams, 2011; Hyde & Mertz, 2009; Riegle-Crumb et al., 2012; Voyer & Voyer, 2014). Girls frequently outperform boys in gender stereotypical masculine areas (Sikora & Pokropek, 2011; Voyer & Voyer, 2014), and when assessed purely on ability or achievement, there should be more boys in gender stereotypical feminine fields and more girls in gender stereotypical masculine fields.

Given that achievement and ability fail to account for gender segregation across fields of study, more research started to focus on (gender role) socialization practices (Alon & DiPrete, 2015; Correll, 2004; Davis & Pearce, 2007; Hyde & Mertz, 2009). These entail that boys and girls are socialized by their environment (e.g., parents, peers, teachers and media) into different fields of study. A caveat in the literature is that these socialization practices are often assumed and not tested and that we know very little about their consequences for field of study choices. This dissertation aims to increase our understanding of how adolescents' social environment socializes boys and girls into different fields of study.

We focus on two crucial time points in which students in the Netherlands make field of study choices that determine their future educational career paths. Dutch students already make an educational field-related choice in secondary education (at the age of 14 or 15) and they choose a field of study after secondary education (at the age of 16, 17 or 18). In this synthesis, we refer to both choices as *field of study choices*, but talk specifically about *track choices* when we discuss field of study choices *in* secondary education and speak of *field of study choices after secondary education* when we discuss choices *after* secondary education.

1.2 The influence of the social environment

This dissertation focuses on three ways in which the social environment shapes boys' and girls' field of study choices. The first way is indirectly via internalized gender ideologies. Field of study choices are made based on what individuals believe they are good at, what they value in a future occupation and what they like to do. Even though it is the individual making these choices, these beliefs, values and preferences are often influenced by ideas and expectations of their social environment. The social environment in which boys and girls grow up (i.e., peers, parents, media, school) conveys cultural beliefs about what is "appropriate" male or female behavior (i.e., male breadwinner role; female caregiver role). Adolescents internalize these gender role expectations in their gender ideology, which in turn affects many of their choices and behaviors (Davis & Greenstein, 2009). However, the consequences for field of study choices are often assumed, but not tested. In the first part of this dissertation, we contribute to the existing literature by testing whether adolescent's internalized gender ideology leads boys and girls to different fields of study and we shed light on the different mechanisms in which it does so.

The second and third way emphasizes the direct role of adolescents' social environment. The second way is the *home environment* in which we focus on the role of parents and siblings. Parents are an important part of adolescents' social environment and a major influence on their behavior. Previous research mainly focused on how parents' social class and educational background shape field of study choices (Davies & Guppy, 1997; Van de Werfhorst, Kraaykamp, & De Graaf, 2000; Van de Werfhorst, Sullivan, & Cheung, 2003). These are vertical characteristics because they focus on differences in level. We contribute to the existing literature by including horizontal characteristics – parents' occupational field – in the explanation of how parents affect their children's field of study. Moreover, contrary to most of the stratification research that focuses on fathers, we include both mothers and fathers in explanatory analyses.

We also test if parents' influence differs depending on where an adolescent resides. Due to the increasing divorce rate, more and more adolescents live with only one parent and usually the mother (Spruijt & Kormos, 2014). We know that father's absence can negatively affect educational attainment and achievement (De Lange, Dronkers, & Wolbers, 2014; Dronkers, 1994; McLanahan & Percheski, 2008; McLanahan, Tach, & Schneider, 2013), but the consequences for field of study choices are less clear. By evaluating differences in parents' influence for adolescents who live in a two-parent household compared to adolescents who live in a mother-only household, this dissertation takes a first step towards identifying the consequences of household types for field of study choices.

Besides parents, siblings are another important part of adolescents' home environment. Siblings spend a lot of time together, which makes them influential role models (Melby, Conger, Fang, Wickrama, & Conger, 2008; Whiteman & McHale, 2011). Previous research shows that siblings influence each other with respect to many behaviors (Whiteman & McHale, 2011), including academic success, years of education and college choice (Adermon, 2013; Bouchey, Shoulberg, Jodl, & Eccles, 2010; Goodman, Hurwitz, Smith, & Fox, 2016; Melby et al., 2008), but we know little about how siblings influence one another's field of study. We are one of the first to study how older sibling's field of study affects his/her younger sibling's field of study.

The last way in which the social environment shapes boys' and girls' field of study choices is the *peer environment*. Peer influences are particularly essential to study during adolescence when peers become more important relative to parents' influence (Ganotice & King, 2014). We know that friends influence each other's educational outcomes (Cook, Deng, & Morgano, 2007; Hallinan & Williams, 1990; Legewie & DiPrete, 2012), but much less research has evaluated the role of friends in boys' and girls' field of study choices. Friends can play a crucial role in approving or disapproving gender conforming role behavior. How friends think about "appropriate" male or female gender role behavior is therefore often assumed to affect gender differences in fields of study (Frank et al., 2008). We contribute to the literature by testing how friends' gender role expectations are associated with field of study choices. Moreover, given that adolescents' friendships are highly gender-segregated (Mehta & Strough, 2009), we evaluate how the gender composition of the friend group is associated with different field of study choices for boys and girls. In this section, our focus is on students who chose a STEM-related track *in* secondary education and examine how friends affect their STEM choices *after* secondary education. We thus focus on students in the STEM pipeline, which allows us to shed light on how friends affect gender specific leakage of the STEM pipeline.

1.3 Theory and previous findings

In order to explain boys' and girls' field of study choices, we derived hypotheses from two theoretical frameworks. The first is *gender role socialization theory* and concerns processes of learning the social expectations and attitudes associated with one's sex. The second theoretical framework is *resource theory* and focuses on the transfer of field-specific resources by adolescents' social environment that lead adolescents to a field of study.

Gender role socialization theory

Gender role socialization theory states that individuals learn gender role behavior through socialization practices. Adolescents' environment conveys cultural beliefs about what is "appropriate" male or female gender role behavior. These so called traditional gender role expectations prescribe that men are breadwinners, more rational and mathematical, and women are homemakers, caregivers and more emotional and verbal (Davis & Greenstein, 2009; Jacobs & Gornick, 2002). Adolescents incorporate these gender norms in their own gender ideology and act conform the behavioral prescriptions of their gender category because doing so confirms their identity (Akerlof & Kranton, 2000; Sinclair & Carlsson, 2013). Similarly, not conforming to gender role expectations leads to uncertainty, guilt and possible negative sanctions from the environment, which – in general – individuals try to avoid. Because adolescents are still shaping their gender identity, they are very likely to conform to gender roles (Galambos, Almeida, & Petersen, 1990). In this dissertation, we evaluate to what extent traditional gender norms and gender role behavior lead boys and girls to different fields of study.

We use gender role socialization theory to derive hypotheses on how adolescents' internalized gender ideology affects field of study choices and we identify three different underlying mechanisms. A traditional gender ideology can affect how boys and girls evaluate their competence

in certain tasks (competence beliefs), what they value in a future occupation (occupational values) and what subjects they prefer (subject preferences). Ample research shows that boys' and girls' competence beliefs, occupational values and subject preferences are in line with traditional gender role expectations. With respect to competence beliefs, research shows that boys have more confidence in their math or science ability than girls (Correll, 2004; Crombie et al., 2005; Sikora & Pokropek, 2012), who often evaluate their competence in reading, language and social activities more positively (Chow & Salmela-Aro, 2011; Jacobs, Lanza, Osgood, Eccles, & Wigfield, 2002). Similarly, research shows that girls value working with people and emphasize social and altruistic values in their ideal job, whereas boys like to work with things and value economic wealth, prestige and status (Diekman, Brown, Johnston, & Clark, 2010; Jacobs et al., 2002). Lastly, boys often prefer more masculine subjects like science or math, whereas girls often prefer more feminine subjects like arts, humanities or languages (Colley & Comber, 2003; Whitehead, 1996), although results with respect to subject preferences have been less conclusive (Colley & Comber, 2003; Miller & Budd, 1999).

Subsequently, research shows that adolescents make field of study choices based on how they evaluate their competence (Crombie et al., 2005; Osborne, Simon, & Collins, 2003; Wigfield & Eccles, 2000), what they value in a future job (Beal & Crockett, 2010; Diekman et al., 2010), and what subject they like best (Elsworth & Harvey-Beavis, 1999; Lyons, 2006; Van Langen, Rekers-Mombarg, & Dekkers, 2006). In sum, gender role socialization theory predicts that boys and girls with a more traditional gender ideology have more traditional *competence beliefs*, *occupational values* and *subject preferences*. These traditional beliefs, values and preferences will subsequently lead them to more traditional gender stereotypical educational tracks.

Now that we have explained how adolescents' internalized gender ideology affects boys' and girls' field of study choice, we will focus on adolescents' social environment in which they learn these (traditional) gender role expectations. Parents and siblings are important gender role socialization agents and can socialize their children or siblings (subconsciously or consciously) with what they consider "appropriate" behavior for boys and girls. Gender role socialization theory posits that boys and girls learn male and female gender role behavior by watching their parents' or siblings' behavior (Bandura, 1977; Kohlberg, 1966). When it comes to choosing a field of study, parents' occupational field and sibling's field of study might be a particularly important reflection of what is "appropriate" male or female behavior. If adolescents learn these gender role behaviors from their parents' occupational field and subsequently conform to the observed gender roles, then mothers and fathers who are employed in more gender stereotypical feminine and masculine occupational fields will lead their daughter or son to a more gender stereotypical feminine or masculine field of study, respectively. Similarly, older sisters or brothers who have chosen gender stereotypical feminine and masculine fields of study will lead their younger sister or brother to a gender stereotypical feminine or masculine field of study, respectively.

With respect to parents, previous research shows mixed results for this hypothesis, in which some studies find no support for it (Dryler, 1998), whereas other studies find strong support for it (Polavieja & Platt, 2014). The studies that focus on sibling influence in field-related choices mostly tended to examine whether sibling similarities in field of study depend on the siblings being same-sex or opposite-sex. Although this tells us something about how older siblings might *sustain* gender differences in fields of study, it provides little information on how older siblings *increase* gender

differences in fields of study; in other words, how older brothers and sisters lead their younger brothers and sisters to different fields of study.

If we apply gender role socialization theory to the specific role of the mother or father or the brother or sister, it predicts that adolescents copy parents or siblings of the same sex because it is more likely that boys learn "appropriate" male gender role behavior from men and girls learn "appropriate" female gender role behavior from women. This implies that a mother leads her daughter, not her son, to a gender stereotypical field, whereas a father leads his son, not his daughter, to a gender stereotypical field. Similarly, an older sister leads her younger sister, not her younger brother, to a gender stereotypical field, whereas an older brother leads his younger brother, not his younger sister, to a gender stereotypical field. Studies that support these notions are mixed. For parents, some studies find a same-sex effect for boys, but not girls (Dryler, 1998; Støren & Arnesen, 2007), whereas other research finds opposite-sex influence to be more important (Leppel, Williams, & Waldauer, 2001). Also for siblings there are some studies that find (partial) support for a same-sex effect (Goodman et al., 2016; Joensen & Nielsen, 2015b), whereas other studies find no effect of sibling sex composition on field of study choices (Chen 2016), or even find that same-sex siblings are more likely to make gender atypical field of study choices (Anelli & Peri, 2014).

Gender role socialization theory also leads to different expectations for boys based on whether adolescents live in a two-parent household or in a mother-only household. Although this theory states that children mainly copy the parent of the same sex, without the presence of a father it seems plausible that mother's occupational field will have a greater influence on boys in a mother-only household than on boys in a two-parent household. Therefore, mothers who are employed in a more feminine occupational field will lead boys in a mother-only household to a more masculine field of study, compared to boys who live with both their mother and father. Because gender role socialization theory entails that girls copy their mother anyway, we expect no differences in the effect of mother's occupational field between household types for girls.

Gender role socialization theory further predicts how friends play a role in adolescents' field of study choice. Friends play a key role in approving or disapproving gender conform role behavior. They reinforce gender stereotypical behavior and penalize non-conformity (Hannover & Kessels, 2004; Kessels, 2005). Traditional gender role expectations prescribe that STEM-related fields are congruent with the male gender role behavior and incongruent with the female gender role behavior (Buck, Plano Clark, Leslie-Pelecky, Lu, & Cerda-Lizarraga, 2008; Cheryan, Plaut, Handron, & Hudson, 2013; Hilliard & Liben, 2010). Therefore, having friends with more traditional gender role expectations is associated with an increased likelihood of choosing STEM fields for boys and a decreased likelihood of choosing STEM fields for girls. Gender role socialization theory also offers two opposing explanations for how the gender composition of the friend group might lead boys and girls to different fields of study. First, individuals might be more likely to comply with gender-typed norms in same-sex groups than in mixed-sex groups (Drury, Bukowski, Velásquez, & Stella-Lopez, 2013; Hilliard & Liben, 2010), leading to more gender stereotypical educational choices for both sexes. Gender becomes more salient when adolescents have more same-sex friends, since the division between their "own" gender and the "other" gender is more pronounced. Consequently, same-sex friends may activate gender-conforming behavior or penalize non-conformity. Second, same-sex friends might lessen the need to conform to gender norms (Pahlke, Hyde, & Allison, 2014; Schneeweis & Zweimüller, 2012), leading to less gender

stereotypical educational choices for both boys and girls. In a more female environment, girls are less marginalized by boys and have more freedom to explore gender atypical interests and abilities. In general, the evidence is inconclusive and seems to support the first argument more for boys (Anelli & Peri, 2014), whereas it appears to be more in line with the second argument for girls (Favara, 2012).

Resource theory

Based on the stratification literature, resource theory states that adolescents' social environment transfers field-specific resources (e.g., information, skills, but also aspirations) that adolescents can draw upon to make a field of study choice. We call this the theory of *direct transfer* and although research mainly used this argument for the intergenerational transmission of occupational field-specific resources (Jonsson, Grusky, Carlo, Pollak, & Brinton, 2009; Kraaykamp, Tolsma, & Wolbers, 2013), it can also apply to older siblings. Parents or siblings transfer field-specific resources to their child or younger sibling. If adolescents use these resources, then the likelihood of the younger sibling entering a field of study similar to their parents' occupational field or older sibling's field of study increases. Note that these expectations differ to some extent from those based on gender role socialization in which parents and siblings lead to gender stereotypical field of study choices. With respect to parents, studies show that there is intergenerational resemblance between a father's occupational field and both his son's and his daughter's field of study (Van de Werfhorst, De Graaf, & Kraaykamp, 2001; Van de Werfhorst & Luijkx, 2010). However, only a few studies have looked at the effect of mother's occupation in addition to father's on their children's field of study, and those that do provide mixed results. There is some support for direct transfer theory (Dryler, 1998), but other studies show that the relationship between parents' occupational field and adolescents' field of study is not straightforward (Leppel et al., 2001; Støren & Arnesen, 2007). With respect to siblings, the few studies that looked at educational-related outcomes do show support for the theory of direct transfer. Older siblings are more likely to lead their younger siblings to a similar college (Goodman et al., 2016) or to a similar subject (math and science) choice (Joensen & Nielsen, 2015a, 2015b).

Assuming that adolescents want to reach a social class as good as, or better than, that of their family, the theory of direct transfer predicts that boys and girls will be likely to use the resources of the parent with the highest occupational status (who is more dominant; Hetherington, 1965; Korupp, Ganzeboom, & Van der Lippe, 2002). We know of only one study that has evaluated the consequences of parental dominance for adolescents' field of study, which found weak support for a dominance effect (Dryler, 1998). A similar argument might apply to siblings. Siblings who are older in age and higher educated are more likely to have more skills and knowledge, which increases their dominance/status. The theory of direct transfer therefore leads to the expectation that younger siblings are more likely to follow their older sibling's field of study when they differ more in age or when the older sibling is higher educated. Contrary to this expectation, previous research shows that siblings similarities in educational choices are more likely to occur when siblings differ less in age (Goodman et al., 2016; Joensen & Nielsen, 2015a, 2015b).

Parents' intergenerational transmission of occupation-specific resources could differ depending on where an adolescent resides. When adolescents live with only their mother, boys and girls can only draw upon their mother's occupational resources. Moreover, in a mother-only

household, the mother is automatically the more dominant parent. Thus, on average, mothers who are occupied in a more feminine occupational field will lead both boys and girls in mother-only households to a more feminine field of study than mothers in two-parent households.

1.4 Contributions

This dissertation aims to explain adolescents' field of study choices and to shed light on the mechanisms that leads boys and girls to different fields of study. A first contribution to the existing literature is that we distinguish three ways in which the social environment affects field of study choices. By looking at adolescents' internalized gender ideology, the influence of the home environment and the influence of the peer environment, we provide an overview of the different ways in which adolescents' social environment lead boys and girls to different fields of study.

A second contribution of this dissertation lies in its focus on two theoretical frameworks – gender role socialization theory and resource theory – to explain boys' and girls' field of study choices. By contrasting these two theories, we increase our understanding of how adolescents' social environment leads boys and girls to (different) educational fields. Moreover, gender role socialization theory and resource theory allow us to evaluate alternative explanations of how gender differences in fields of study arise that ability and achievement fail to explain. With our focus on gender role socialization we are also one of the first to test – not assume – how gender role socialization affects the fields of study boys and girls enter.

A third contribution is that we are able to focus on two crucial time points in individuals' educational career that determines their future educational career path. By focusing on field of study choices *in* secondary education and field of study choices *after* secondary education, we are able to give a first indication on which mechanisms are important at different time-points in adolescents' educational career.

The data used also offers several advantages to effectively answer this dissertation's main research question. We use data from the project "Children of Immigrants Longitudinal Study in Four European Countries" (CILS4EU; Kalter et al., 2014, 2015, 2016a, 2016b) and the follow-up of this project in the Netherlands, "Children of Immigrants Longitudinal Survey in the Netherlands" (CILSNL; Jaspers & van Tubergen, 2014, 2015). The longitudinal design allows us to examine field of study choices at two time points. Moreover, the data contains information on gender ideology and cognitive tests, which makes it possible to evaluate the role of gender ideology over ability. Finally, we have the unique opportunity to test how the home environment and the peer environment affect field of study choices because parents and peers also participated.

1.5 Dutch educational system

The educational system of the Netherlands is displayed in figure 1.2. In the Netherlands, secondary education starts at the age of 12 and is compulsory until obtaining the "starting qualification" at the upper secondary level (age 17 or 18). Students can enter one out of three possible levels of secondary education depending on their grades, test results, and teachers' recommendation. The

majority enters VMBO, or the vocational level. This is a four-year vocational program after which pupils continue in secondary vocational education (MBO). The two other levels both provide access to higher education. The HAVO, or the general level, is a five-year program preparing students for universities of applied science that offers professional Bachelor degrees (higher vocational education: HBO). The VWO, or academic level, is a six-year program that prepares pupils for a research university that offers academic Bachelor degrees. Adolescents can always enter a lower level after secondary education. For example, students who finished the academic level can enter higher vocational education.

This dissertation evaluates field of study choices in secondary education (the dashed line in figure 1.2) and after secondary education (the dotted line in figure 1.2). At the end of their second (vocational level; 14 years old) or third (general or academic level; 15 years old) year of secondary education, Dutch adolescents choose one of four tracks. For the vocational level, students can choose between Technology, Agriculture, Health & Wellbeing, and Economics. In the general or academic level these options are: Science & Technology, Science & Health, Economics & Society, and Culture & Society. Because students in the vocational level make their educational choices at a different time point than students in the general and academic level, the data only allowed us to study track choices of adolescents in the general and academic level. In these tracks, Science & Technology is the most math-intense, followed by Science & Health, Economics & Society and Culture & Society. These educational track choices in secondary education greatly influence adolescents' future educational career. Science & Technology allows adolescents to enter all fields (e.g., engineering, biology, economics, and humanities) after secondary education. Science & Health allows students to enter most fields, but excludes the ones that are most math-intense (e.g., excludes engineering). After finishing Economics & Society adolescents can enter economic-orientated fields and all fields associated with culture and society (e.g., excludes engineering and biology). Finishing Culture & Society only allows adolescents to enter all fields concerning culture and society (e.g., excludes engineering, biology and economics). This works in a similar way for students who finish the vocational level. The Technology track allows students to enter all fields of study (e.g., construction, farming, business school, and pedagogic work). Agriculture educates students for agricultural fields and excludes the most technical fields (e.g., excludes construction). Economics leads to economic-orientated fields and allows students to enter fields concerning health and wellbeing (e.g., excludes construction and farming). Health & Wellbeing allows students to enter fields of study related to health and wellbeing (e.g., excludes construction, farming and business school).

Students in the vocational, general or academic level enter a field of study after secondary education at different time points. In order to finish compulsory education and get the "starting qualification", students who completed the vocational level are required to continue in secondary vocational education (MBO) for at least two years. These students enter a field of study when entering secondary vocational education (age 16). Students who finished the general level (age 17) and the academic level (age 18) have completed compulsory education and students who continue their education (most of them do) choose a field of study.

The Dutch educational system provides a unique opportunity to investigate which fields adolescents enter for at least two reasons. First, it allows us to study influential field of study choices made at a relatively young age. Whereas in other countries (e.g. Sweden; Van Langen & Dekkers,

2005), it is relatively easy to switch tracks at a later point, the choices Dutch students make in secondary school are more restrictive, and to repeal such choices is much harder. Second, students in the Netherlands choose their field of study after secondary education at registration for college. Unlike other countries where students mainly choose their field of study in tertiary education (for example choosing a major in the United States), students in the Netherlands make these choices at all levels (MBO, HBO & University). This dissertation is therefore able to focus on a wider group than only tertiary-level students

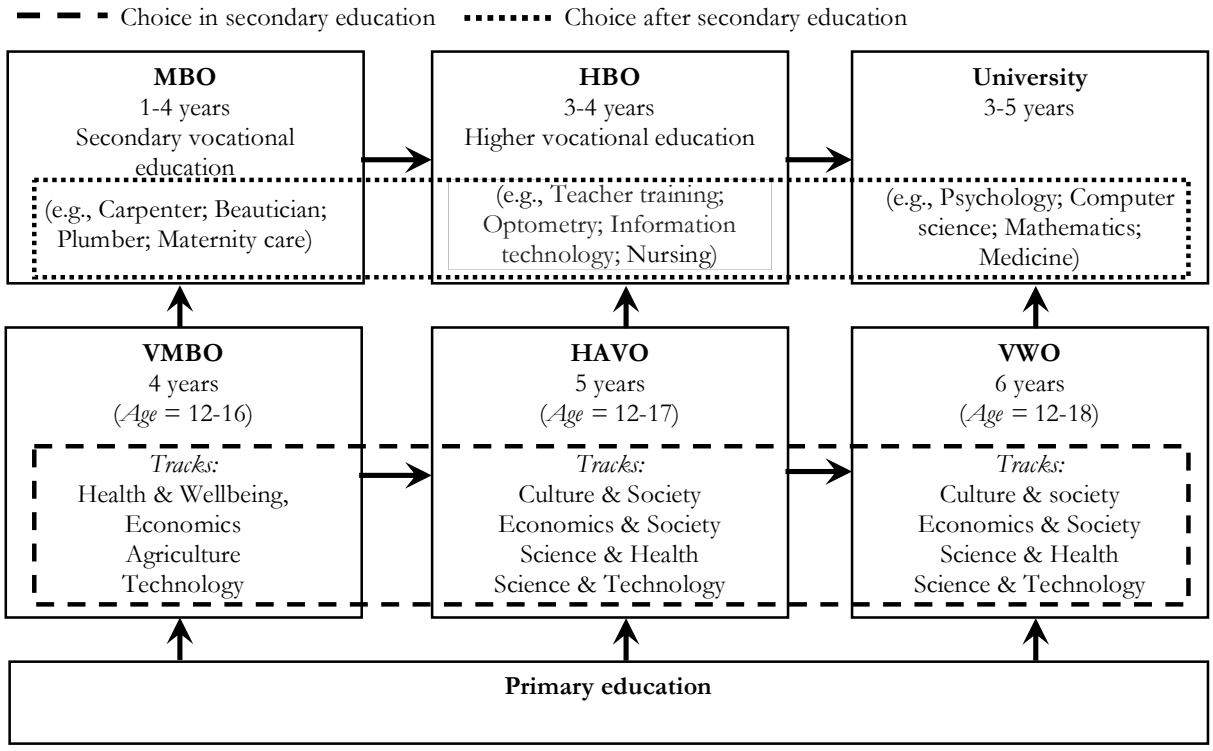


Figure 1.2 The educational system in the Netherlands.

1.6 Data

We use four waves of data from the project "Children of Immigrants Longitudinal Study in Four European Countries" (CILS4EU) and the follow-up of this project in the Netherlands, "Children of Immigrants Longitudinal Survey in the Netherlands" (CILSNL). The main aim of the CILS4EU data was to explore the structural, cultural, and social integration of immigrant and non-immigrant children in Germany, the Netherlands, Sweden and the United Kingdom. We use the data collected in the Netherlands. The first wave of the CILS4EU was collected in 2010/2011 (M_{age} = 14 - 15; 9th grade) and the second wave was collected in 2011/2012 (M_{age} = 15 - 16; 10th grade). The fourth and fifth wave are part of the CILSNL project and are collected in 2014 (M_{age} = 18) and 2015 (M_{age} = 19), respectively.

The CILS4EU sample was drawn using a three-stage-stratified sampling design. First, schools were randomly sampled, with an oversampling of large schools and schools with a higher proportion of immigrant children. The initial response rate among schools in the Netherlands was

34.9%. In order to increase this response rate, schools that refused to participate were replaced with schools highly similar to the initially sampled schools in terms of the proportion of immigrant children and their education level. This led to a school response rate of 91.7% after replacement. Second, two classes were randomly selected to participate (class level response rate = 94.5%). Third, all students in the class were asked to participate (student level response rate = 91.1%). In total, in wave 1, 4,363 students participated in 222 classes in 100 schools. The response rate of wave 4 is 55.5% and wave 5 is 54.4%, both calculated as the ratio between the number of respondents who participated and the number of adolescents who had been approached and did not refused participation before the start of wave 4 or 5, respectively. In wave 1 and wave 2, most respondents participated by filling in a self-completion questionnaire in their class at school. In wave 4 and 5, a mixed mode approach was used. Most students filled in an electronic questionnaire (wave 4: 69%; wave 5: 85%), some participated by telephone (wave 4: 21%; wave 5: 14%) and few preferred to fill in a paper questionnaire (wave 4: 10%; wave 5: 1%).

In the first and second wave, a large group of extra students became part of the sample that was originally not part of the sampling frame (wave 1: n = 600 & wave 2 n = 2127). In wave 1, this was mainly because some schools only wanted to participate if more than two classes participated. In wave 2, this was mainly because classes were restructured between wave 1 and wave 2 and one of the aims of CILS4EU was to gather information on whole classes. Therefore, at wave 2, all students within a class participated, even when not all students in that class were part of the original sampling frame.

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%).

These data offer several advantages to answer our main research question. First, the longitudinal design allows us to evaluate field of study choices in and after secondary education. Moreover, due to the longitudinal design, gender ideology is measured before adolescents made their field choices, which makes it more plausible that gender ideology affects the fields adolescents enter than the other way around. Otherwise it could be that certain (masculine or feminine) fields of study might influence how adolescents think about "appropriate" male or female gender role behavior. Second, standardized cognitive tests (spatial and language) were administered, which allow us to research the role of gender ideology controlled for a proper measure of (spatial and verbal) ability. Third, because parents participated, we have reliable information on parents' characteristics (e.g., parents' occupation and level of education), as well as other characteristics of the home environment (e.g., living situation). Although children can reliably report information on their parents, self-reported information is often more accurate (Vereecken & Vandegehuchte, 2003; West, Sweeting, & Speed, 2001). Lastly, the data provide information on adolescents' friends in class. Students could nominate up to five best friends in class. Because complete classes participated, we additionally have all information on respondents' five best friends in class (given that they also participated). This allows us to adequately test how the peer environment is associated with adolescents' field of study choice.

The definition of field of study in different chapters

Our dependent variable is measured slightly different throughout this dissertation (see also table 1.1). All measures allow us to evaluate which fields of study adolescents choose and whether choices differ between boys and girls. Chapter 2 (adolescents' internalized gender ideology) focuses on educational track choices *in* secondary education. Based on the number of girls in these tracks retrieved from Statistics Netherlands, these tracks can be classified as masculine or feminine. Chapter 3, 4 and 5 focus on field of study choices *after* secondary education. Chapter 3 (parents' influence) aims to directly explore the masculinity and femininity of boys' and girls' educational choice by using the percentage of female students enrolled in the relevant field of study in the Netherlands in 2013/2014 or 2014/2015 (depending on when adolescents chose a field of study). Chapter 4 (sibling influence) differentiates between five different field categories. Like chapter 2, these field categories can be classified as masculine or feminine based on the number of girls in these fields retrieved from Statistics Netherlands. Chapter 5 (peer environment) focuses on STEM choices. This chapter tests whether friends lead boys or girls to the more masculine STEM fields or not.

1.7 Overview of dissertation

Table 1.1 provides an overview of the empirical chapters in this dissertation. For each chapter, the table states the main aim, the theories used to derive hypotheses, the main contributions, the dependent variable and the waves of the CILS project used.

1.8 Main results

In this section, we summarize our main findings and conclusions per theory and per influence of the social environment.

Gender role socialization

Adolescents' internalized gender ideology

Based on gender role socialization theory, we argued that adolescents with a more traditional gender ideology have more traditional competence beliefs, occupational values and subject preferences, which leads them to more gender stereotypical educational tracks. Results show that a more traditional gender ideology leads to more traditional occupational values and subject preferences for boys, but not girls. In line with the traditional breadwinner ideology, boys with a more traditional gender ideology value having a high income and find helping others less important in a future occupation. Similarly, boys with a more traditional gender ideology have more masculine subject preferences. Consequently, they are more likely to enter a more masculine track (Science & Technology) and less likely to choose the more feminine tracks (Science & Health; Culture & Society).

Table 1.1 *Overview of aims, theories, contributions, dependent variable, and data used per chapter.*

Ch.	Main aim of chapter	Contributions	Dependent variable
			In secondary education
2	Test how adolescents' internalized gender ideology affects their field of study choice *Theory:* Gender role socialization theory	1. Test - not assume - the effect of gender ideology 2. Investigate the underlying mechanisms - competence beliefs, occupational values and subject preferences – of how gender ideology affects field of study choice	1 Science & Technology 2 Economics & Society 3 Science & Health 4 Culture & Society *Data:* CILS4EU: wave 1 & 2
			After secondary education
3	Test how parents' occupational field affects adolescents' field of study choice and test differences in parents' influence between household types *Theory:* Gender role socialization theory & resource theory	1. Investigate the role of parents' horizontal characteristics 2. Investigate the role of mother's occupation in addition to father's 3. Contrast gender role socialization and resource theory to explore the underlying mechanisms of parents' influence 4. Investigate differences between mother-only and two-parent households	Percentage of same-sex adolescents in field of study *Data:* CILS4EU: wave 1 & 2 CILSNL: wave 4 & 5
4	Test how older sibling's field of study affects younger sibling's field of study choice *Theory:* Gender role socialization theory & resource theory	1. Investigate the role of older siblings 2. Contrast gender role socialization and resource theory to explore the underlying mechanisms of sibling influence	1 Education, humanities, arts & social sciences 2 Business & law 3 Science & engineering 4 Health, biology, agriculture & veterinary 5 Services *Data:* CILSNL: wave 5
5	Test how friends' gender ideology and the gender composition of the friend group affect adolescents' field of study choice *Theory:* Gender role socialization theory	1. Test - not assume - the effect of friends' gender ideology 2. To investigate two opposing ideas of whether same- or opposite-sex friends lead to gender differences in fields of study 3. Focus on adolescents in the STEM pipeline to shed light on how friends affect gender-specific leakage in the STEM pipeline	STEM/non-STEM fields *Data:* CILS4EU: wave 2 CILSNL: wave 4 & 5

Gender ideology was not related to girls' mathematical competence beliefs or to boys' verbal and mathematical competence beliefs. Contrary to our expectations, a more traditional gender ideology leads girls to evaluate their verbal competence more negatively. They are subsequently less likely to choose a gender stereotypical feminine track (Culture & Society) and more likely to choose a gender stereotypical masculine track (Science & Technology). One possible explanation could be that we measured gender ideology in terms of the caregiver/homemaker role. Although the caregiver role and verbal competence can both be considered feminine, it could be that those are two separate domains. Therefore, measuring competence beliefs in term of caregiving might provide more information about educational choices. Another explanation could be that girls who adhere to more traditional gender ideology believe that they should be really good at languages and thus underestimate their competence.

The finding that gender ideology does not affect girls' or boys' mathematical competence beliefs could indicate that gender stereotypes associated with math are changing. Recent research

shows that more students do not consider math a typically masculine domain anymore (Kurtz-Costes, Copping, Rowley, & Kinlaw, 2014; Plante, Théorêt, & Favreau, 2009), which explains why we do not find an effect of gender ideology on boys' or girls' mathematical competence beliefs.

Overall, gender ideology influences boys' educational choices because it affects what they consider important in the future as well as what they enjoy doing right now, leading to more gender stereotypical educational choices. In the case of girls, gender ideology does not lead to more gender stereotypical track choices. In line with gender role socialization theory, norms surrounding what is "appropriate" male or female gender role behavior leads boys to a more masculine educational track choice and away from more feminine tracks. The fact that we find this for boys, but not for girls, is in line with research that shows that whereas it is becoming increasingly more accepted for girls to make more masculine choices, there is less acceptance of cross-gendered choices for boys (Kane, 2006; Perra & Ruspini, 2013).

Home environment

Gender role socialization theory states that adolescents learn gender role behavior from their parents' or siblings' behavior. In line with this theory, we find that mother's behavior – not father's – exemplifies "appropriate" behavior for one's sex category, although her influence is not large. Mothers who are employed in a more feminine occupational field lead both boys and girls to more gender stereotypical masculine and feminine fields of study, respectively. Our results are in line with previous studies that concluded that mothers in a nontraditional occupational field result in adolescents choosing nontraditional fields (Leppel et al., 2001; Polavieja & Platt, 2014; Støren & Arnesen, 2007). However, whereas these studies find this effect only for girls (Polavieja & Platt, 2014) or boys (Leppel et al., 2001; Støren & Arnesen, 2007), we conclude that mother's occupation affects both boys' and girls' field of study. For fathers and siblings, we find no support for gender role socialization theory. We find no evidence that the masculinity of father's occupational field affects boys' or girls' gender stereotypical field of study choice. Similarly, we find no support that an older brother or sister who is in a gender stereotypical masculine or feminine field of study leads his/her younger sibling to a gender stereotypical field of study.

Also, contrary to gender role socialization theory, we find no evidence that boys and girls enter different fields of study because they are more likely to learn "appropriate" gender role behavior from their same-sex parent or sibling. Mothers influence both boys and girls and fathers and siblings do not lead to gender stereotypical field of study choices.

Based on gender role socialization, we also argued that adolescents who live with only their mother have less exposure to male-typical role models. Without the presence of a father, it seems plausible that mother's occupational field will have a greater influence on boys in a mother-only household than on boys in a two-parent household. In line with other research (Brolin Låftman, 2008), we find no difference in the influence of mother's occupational field between adolescents from a two-parent household and adolescents from a mother-only household.

Peer environment

Traditional gender role expectations prescribe that STEM fields are congruent with the male gender role behavior and incongruent with the female gender role behavior (Buck et al., 2008; Cheryan et al., 2013; Hill et al., 2010). Therefore, having friends with more traditional gender norms is

associated with a lower likelihood of girls choosing STEM fields, and with a higher likelihood of boys choosing STEM fields. We found support for this prediction for girls, but not for boys. Friends' gender norms were important irrespective of girls' own gender ideology. Due to our focus on students in the STEM pipeline, we can conclude that friends' gender norms push girls out of the STEM pipeline after secondary education.

We found that boys are more likely to choose STEM fields when they have more males in their friend group. Although this is in line with research that finds that individuals might be more likely to comply with gender-typed norms in same-sex groups than in mixed-sex groups (Drury et al., 2013; Hilliard & Liben, 2010; Martin & Fabes, 2001), friends' gender norms seem unimportant for the fields boys enter. Gender role socialization theory therefore does not seem to explain how friends influence boys' field of study choice.

Resource theory

We expected that adolescents enter a similar field of study as their parents' occupational field or their older sibling's field of study because parents and older siblings transfer field-specific resources to their children or younger siblings. With respect to parents, we found little support for the theory of direct transfer when our dependent variable is the masculinity or femininity of a field of study (chapter 3). However, we do find support for this theory when our dependent variable is field of study classified in five field-categories (chapter 4). Father's occupational field increases the likelihood that sons choose a similar field of study and this effect is similar for all occupational fields in which the father is employed. We found no such effect for mother's occupational field. This means that whereas mothers socialize their children into masculine or feminine fields of study (chapter 3; a nurse leads daughter to humanities and son to mathematics), she does not lead her children to similar fields (chapter 4). Fathers lead their sons to similar fields (chapter 4; an accountant leads his son to accounting), but he does not socialize his children into masculine and feminine fields (chapter 3). Our results also support the theory of direct transfer for siblings. The older sibling's field of study increases the likelihood that his/her younger sibling chooses a similar field. We find this not only for the older sibling closest in age, but also for subsequent older siblings. The effect of older sibling's field of study was present irrespective of parents' occupational field and is comparable in size to the effect of father's occupational field on son's field of study.

Contrary to direct transfer theory, we find no evidence for dominance effects for either parents or siblings. Boys and girls are not more likely to use the occupational resources of the parent with the highest status and sibling influence is not stronger when siblings differ more in age or when the older siblings is higher educated. Overall, our results are inconclusive as to the conditions under which older siblings exert more influence. Besides older sibling's age and education level, results show that it does not matter *which* field older siblings has chosen, suggesting that older siblings' resources in one field (e.g., economics) are not more useful than those in other fields (e.g., humanities). Furthermore, other studies have highlighted that siblings influence in field of study choices were stronger among brother pairs (Joensen & Nielsen, 2015a, 2015b) or mixed-sex siblings (Anelli & Peri, 2014), but in line with Chen (2016), we conclude that the sex composition of the sibling dyad does not matter.

Lastly, we argued, but do not find, that because boys or girls in a mother-only household can only draw upon their mother's occupational resources, mother's feminine occupational field

would lead boys and girls in mother-only households to a more feminine field of study than mothers in two-parent households.

1.9 Conclusions and future research

This dissertation aimed to explain adolescents' field of study choices and specifically focused on the mechanisms that lead boys and girls to different fields of study. We showed that both gender role socialization theory and resource theory partly explain which fields boys and girls enter, but their merit depends on which aspect of adolescents' social environment we look at.

Conclusions with respect to theory

In line with gender role socialization theory, societal gender role expectations regarding what is "appropriate" male or female gender role behavior can prevent both boys and girls from making cross-gendered educational choices. However, for boys it is their own internalized gender ideology that hampers them from making cross-gendered educational choices in secondary education, whereas for girls it is the traditional gender ideology of their friends – irrespective of their own gender ideology. Boys and girls thus learn that some fields are "inappropriate" choices, because they do not fit the male or female gender role, despite attempts by the Dutch government to change such stereotypes (EACEA, 2009). Although most previous research focused on girls, our results indicate that gender norms also impede boys from making gender stereotypical feminine field of study choices. However, the consequences of gender norms might be more severe for girls than for boys. In the Netherlands, track choices in secondary education limit the field of study options adolescents have after secondary education. We conclude that boys' gender ideology leads boys away from gender stereotypical feminine tracks (Science & Health and Culture & Society) and into a gender stereotypical masculine track (Science & Technology). This track allows boys to enter all masculine and feminine fields after secondary education (e.g., mathematics as well as humanities). This means that boys can restore a choice based on gender role expectations in secondary education by choosing any field after secondary education. For girls, friends' traditional gender norms prevent them from entering cross-gendered fields of study *after* secondary education. As this choice is much more "final", traditional gender norms may have more impact on girls' future educational and occupational career. This way, girls miss out on the professional positions and high earning opportunities that STEM careers offer, which sustains gender inequality in salary and women's underrepresentation in higher status occupations. Irrespective of the possible different consequences for boys and girls, society might be missing out on individuals doing what they do best because adolescents choose what is socially desirable and not based on their full potential. Adolescents might also miss out on fields in which they could flourish because they make socially desirable choices. In order to mitigate the effects of gender norms it is important to further increase our understanding of what these norms entail and how they work.

Also in line with gender role socialization theory, mothers who are employed in more feminine fields socialize sons and daughters into gender stereotypical fields of study. Her influence was not large, but it does mean that if mothers are occupied in a non-traditional occupational field (e.g., plumber) this could decrease gender segregation in fields of study. Although previous research

mainly focused on vertical characteristics and fathers (Davies & Guppy, 1997; Van de Werfhorst, Kraaykamp, & De Graaf, 2000; Van de Werfhorst, Sullivan, & Cheung, 2003), our findings highlight the need to include mothers – next to fathers – in studying adolescents' field of study choices.

Resource theory seems to better explain how fathers and siblings affect field of study choices. Fathers and older siblings lead their sons or younger siblings to a *similar* field, irrespective of the masculinity or femininity of their field. This is congruent with the idea that sons or younger siblings use their father's occupation specific resources or their older sibling's educational field-specific resources to choose a field of study (Jonsson et al., 2009; Van de Werfhorst & Luijkx, 2010). Older siblings were important for the fields their younger siblings enter irrespective of their parents' occupational field. In line with other research that looked at college attendance (Ceja, 2006; Mwangi, 2015), this indicates that both siblings *and* parents are important information sources for entering fields of study. Furthermore, results imply that whereas mothers contribute to gender differences in fields of study, fathers and sibling do not lead to gender differences in educational fields.

Not in line with either gender role socialization theory or resource theory is the finding that same-sex friends detain boys in the STEM pipeline after secondary education. As this was not explained by gender norms of the friend group, this is most likely to result from the fact that same-sex friends share gender-typed interests and activities (Martin et al., 2013). Overall, our results with respect to the peer environment show that adolescents' friends increase gender differences in fields of study, although for boys it is having more same-sex friends, whereas for girls it is their friends' gender ideology.

To summarize which mechanisms contribute to different field of study choices for boys and girls, this dissertation showed that adolescents' internalized gender ideology contributes to gender inequality in educational fields because it leads boys to more masculine fields of study. Mothers and friends also increase gender differences in fields of study. Mother's feminine occupational field leads boys and girls to more gender stereotypical fields of study and whereas friend's gender ideology pushes girls out of the STEM pipeline, having more same-sex friends detains boys in these masculine fields. Lastly, fathers influence sons and siblings influence younger brothers and sisters to choose similar fields, but these actors do not contribute to gender differences in fields of study.

Tentative conclusions that need further research

We should be cautious with drawing conclusions about the relative importance of the actors in adolescents' social environment – mothers, fathers, friends or siblings – because we were not able to systematically test this. Though we found that the influence of older siblings and fathers are equally large, future research should further explore in what way their influence intertwines. For example, on the one hand, it is likely that parents' occupational field influenced older sibling's field of study. Therefore, part of the effect of father's occupational field might run via older sibling's field of study. On the other hand, parents may also learn from their older child(ren)'s field of study (choice process), which could subsequently affect their younger child(ren)'s field of study choice (Ceja (2006) found this for college choices). Moreover, we encourage future research to include friends into this equation as well. As siblings do not lead to gender differences in fields of study,

this could indicate that older siblings provide the opportunity to learn cross-gendered behaviors in "peer-like" relationships, which might be important given that friends reinforce gendered choices. Overall, this dissertation shows that different actors in adolescents' social environment are important for the fields adolescents enter and to increase our understanding of gender differences in educational choices, this field could benefit from research that studies the relative contribution of friends, siblings and parents.

Another avenue for future research is to study whether behaviors or attitudes are more important for the fields of study adolescents enter. Our results highlight that both (gendered) behaviors (occupational field and field of study) and attitudes (gender ideology) are important for the fields adolescents enter, but behaviors and attitudes do not necessarily coincide. For example, a mother with a non-traditional gender ideology could be occupied in a gender stereotypical occupation (nurse). If they do not coincide, which one is more important? Unfortunately, the data did not allow a direct comparison between behaviors and attitudes of friends or siblings, but we were able to do this for parents. These extra analyses (not shown in the dissertation) revealed that parents' gendered occupation (behavior) is more influential for the fields of study their children enter than their (gendered) attitudes. One explanation for why behaviors are more influential than attitudes is that they are more constrained by cultural gender norms (Alon & DiPrete, 2015). For example, Alon and DiPrete (2015) found that students' field of study choice (behavior) was more gendered than the broader set of fields that they considered (attitudes). If behaviors are more gendered than attitudes, these behaviors are likely to be more influential for (educational) decisions than attitudes. In other words, mother's (gendered) behavior (occupational field) will result in adolescents choosing a (gendered) field of study, whereas her (traditional) gender ideology will not.

This could however be different for friends and/or siblings. It is unlikely that parents change to a completely different occupational field (from nurse to engineer), but results do show that their gender role attitudes become more gender egalitarian over time (Judge & Livingston, 2008). Because parents have chosen their occupational field at a young(er) age, when their gender role attitudes were likely to be more traditional, it is likely that their occupation (behavior) is more gendered than their attitudes. Friends or siblings are younger and (thus) have chosen their field of study more recently than parents. Therefore, the gap between friends' or siblings' attitudes and their behavior would be smaller than the gap between the attitudes and behaviors of parents, given that friends' and siblings' choices are based on their gender ideology. This could mean that friends' or siblings' attitudes matter more or as much for adolescents' field of study choice as their behavior. To increase our understanding of adolescents' educational choices, future research should explore the interplay between attitudes and behavior of adolescents' social environment.

Although we could not systematically test this, our findings suggest that gender norms play a different role for boys and girls depending on the time point at which boys and girls make educational decisions. Gender norms detain boys in the STEM pipeline *in* secondary education, whereas they push girls out of the STEM pipeline *after* secondary education. We explained that in the Dutch educational system, this does not have severe consequences for boys, which contradicts research that claims delaying curricular choice weakens the effect of gender norms on course taking (Buchmann & Dalton, 2002; Gerber & Schaefer, 2004). We were unfortunately unable to study how parents, siblings or peers influence adolescents' educational choice *in* secondary education, but it might be that the importance of these actors is different for this choice compared to choices

after secondary education. For example, research shows that parents are more influential when children are younger and that peers become more influential during adolescence (Ganotice & King, 2014). Future research should study the importance of these actors on early field choices in secondary education.

This dissertation mainly focused on horizontal characteristics, but this field could greatly benefit from research that explores how horizontal and vertical characteristics intersect. For example, parents with higher education levels or occupational status might have more useful occupational resources that lead their children to choose more prestigious – masculine – fields (Van de Werfhorst et al., 2003). Another argument is that gender role socialization occurs more in families with a lower socio-economic status, because traditional gender norms are more prevalent in these families (Davis & Greenstein, 2004). This would lead to gender typical field of study choices for children from lower SES families compared to children from higher SES families (Van de Werfhorst, 2017). Although we found no support that parents with a higher occupational status or a higher level of education lead adolescents to more masculine and/or prestigious fields, our results did show support for both lines of reasoning when we look at the separate role of mother and father. We found some evidence (see chapter 3) that when the stakes are higher (for children from higher-educated parents and children in higher levels of education) children are more likely to profit from the resources of their father. When the stakes are lower, mothers socialize their children in "appropriate" gender roles. Studies should examine if field of study choices differ depending on socio-economic background (like some previous studies; Kraaykamp et al., 2013; Van de Werfhorst, 2017; Van de Werfhorst & Luijkx, 2010), but our results indicate that it is important to look at the specific role of the mother and the father.

Further suggestions for future research

Gender differences within STEM fields are another area that would benefit from further research. Research shows that girls have become overrepresented in the biological sciences and have made substantial inroads in chemistry, but they remain underrepresented in engineering, physics, and computer science (Gerber & Cheung, 2008). Similarly, girls are more likely than boys to choose health-related fields. Although it is debatable whether health fields are part of the STEM-definition (and more often they are considered not to be), one argument to include them is that they offer similar benefits as STEM fields (e.g., high earning potential and occupational status). Understanding why girls choose for biological and/or health-related fields and not for other STEM fields could aid to our understanding of why boys and girls choose different fields in general. One explanation often mentioned is that biological and health-related domains can be categorized as more social and people-oriented, which are, according to traditional gender role expectations, considered more feminine characteristics that attract girls to these fields (Sikora & Pokropek, 2012; Su, Rounds, & Armstrong, 2009). In line with this reasoning, this dissertation showed that boys who have a more traditional gender ideology find helping others less important in a future job, and shy away from a biology track in secondary education (chapter 2). However, we found no evidence that friends and siblings lead to differences between boys and girls in biological or health-related field choices (chapter 4 and 5).

Furthermore, future research should look at differences between adolescents with a (non-western) immigrant background and their western peers. Overall, we found that migrant boys and

girls are more likely to choose economic fields after secondary education. A possible explanation is that non-western ethnic minorities choose more lucrative fields to compensate for their relatively lower socio-economic status. For choices in secondary education, we found that girls, not boys, with a migrant background are more likely than Dutch girls to choose a science track and less likely to choose an economic track. However, this result was not so much driven by the science choices of migrant girls, but more that non-migrant girls only enroll in the economic track and not in the (masculine) science track. Our results further showed that the influence of the social environment could work differently for adolescents from different migrant backgrounds. For example, we found that especially mothers were an important influence for adolescents with a non-western immigrant background (chapter 3). This could be because women who work are (even) more unusual in non-western societies. So if they do work, they have a large influence on their sons and/or daughters. With diversifying European societies, it is relevant to look at how adolescent boys and girls from diverse immigrant backgrounds make different educational choices.

1.10 Limitations

Although this dissertation contributes to our understanding of the mechanisms that lead boys and girls to different fields of study, it also has some limitations. First, except for some sensitivity analyses, we were unable to test the combined influence of adolescents' internalized gender ideologies, the home environment and the peer environment, because the number of observations would be too few to draw reliable conclusions. As we already explained, this field would benefit from studies that combine these different levels of influence. Moreover, adding teachers to this equation could be important as well. We were not able study the role of teachers, but teachers play a major role in adolescents' educational career and can be very important gender role socialization agents (Li, 1999; Sáinz, Pálmen, & García-Cuesta, 2011).

Second, although the Dutch context offers us a unique opportunity to evaluate field of study choices, there are several reasons why we should be careful generalizing our results to other contexts. Fields of study in the Netherlands are chosen in and after secondary education. We know that the effect of social background is reinforced by multiple educational transitions (Brunello & Checchi, 2007), which could also be the case for other mechanisms like gender ideology. In secondary education, Dutch students are grouped together based on the track they choose. If gender ideologies guide these choices, then they will be surrounded with individuals who have a similar gender ideology. This could reinforce the effect of gender ideology on field of study choices after secondary education. Although our results show no support for this notion, we were unable to systematically test this. Future research should therefore further study the consequences of multiple educational decisions for the fields adolescents enter. Furthermore, students in the Netherlands choose a field of study after *all* levels of secondary education. If mechanisms that lead boys and girls to different fields vary across levels of education (the intersection of horizontal and vertical characteristics as explained in 1.9), then results might be different for educational systems that do not use early tracking or in systems in which field of study choices are only made at a specific educational level (like the US, where students choose their field of study after secondary education in tertiary level). Finally, the Netherlands are considered to be to one of the most gender

egalitarian countries of the world (World Economic Forum, 2016). It would be worthwhile to compare how gender role expectations affect field of study choices in contexts with different levels of gender equality. Despite the high gender equality, gender segregation on the labor market is quite pronounced in the Netherlands and many women, and mothers, work part time (Bettio & Verashchagina, 2009). Because part-time mothers spend more time at home, the effect of mother's occupation could come from a general socialization effect that results from spending time with her child. Unfortunately, we were not able to take into account parents' employment hours, but in order to disentangle this effect, future research should compare mothers with different (or no) employment hours. Similarly, given that part-time working jobs are often more feminine and full-time jobs more masculine (OECD, 2002), the effect of mother's occupational field could also be a result of the fact that daughters learned from their mother's feminine occupation that it is "appropriate" for women to work in feminine part-time fields, whereas boys learned that it is "appropriate" for men to work in more masculine full-time fields. In order to disentangle this effect, future research should compare the effect of mother's occupational field by comparing countries with differing levels of part-time employment.

Third, we were unable to control for selection effects in the effect of friends' gender ideology. We conclude that friends' gender ideology is associated with field of study choices, but if adolescents select friends based on their norms, the causal relation between friends' gender norms and the fields adolescents enter is not that straightforward (Mouw, 2006; Steglich, Snijders, & Pearson, 2010). Unfortunately, our data were not suited for social network analyses because classes were too unstable between waves, but future research on peer influence in field of study choices could benefit from advanced statistical tools that disentangle the processes of selection and influence within friend circles (Steglich et al., 2010). Moreover, as students were asked about their friends in class we were only able to include classroom friends. Future research could investigate the effect of outside classroom friends as well.

Lastly, research shows that the relationship quality between siblings or the amount of time siblings spend together affects sibling influence (Slomkowski, Rende, Novak, Lloyd-Richardson, & Niaura, 2005; Whiteman & Christiansen, 2008). Unfortunately, the data did not allow us to take this into account and we encourage future research to study how sibling influence in field of study choices might differ depending on siblings' relationship quality and time spent together.

1.11 Practical implications

The findings of this dissertation have several practical implications that can guide policy makers, parents, schools and teachers. In writing the practical implications of this dissertation, I also draw upon the expert meeting I organized on gender differences in field of study choices in Oxford, United Kingdom (September 2016). In this meeting, 14 experts (policy makers and scientists) from different countries (Norway; United Kingdom; Germany; Belgium; Luxembourg; Sweden; The Netherlands) discussed the findings and implications of this dissertation.

This dissertation shows that gender normative ideas of what is "appropriate" male or female behavior impedes boys and girls from choosing cross-gendered fields of study in the Netherlands. One way to reduce gender differences in fields of study would be to tackle the

persuasiveness of these gender norms. The experts concurred that gender norms are influential and highlighted that it is especially important to include schools and parents in policies aimed to reduce the persuasiveness of these norms. Adolescents spend most of their time at school or at home. It is in these contexts that their (traditional) gender role behavior is (in)validated and educational choices are made.

We extensively discussed that one fruitful way to reduce the effect of gender norms is by using (important) role models in gender atypical educational or occupational fields (Dasgupta & Stout, 2014; Young, Rudman, Buettner, & McLean, 2013; Zirkel, 2002). The contact with role models in gender atypical fields could counteract gender normative ideas about what is considered "typical behavior" for boys and girls. It can encourage students to choose gender atypical fields and to feel more confident about these choices. The Dutch National Expert Organization on Girls/Women and STEM (VHTO) have organized some of these events for girls, with success (Booy et al., 2012; Jansen & Joukes, 2012). For example, they organized guest lectures (at school) that show the interesting career of female scientists; speed dates with role models in diverse professions and "shadow days" in which adolescents can sign up to experience one workday of a certain (STEM-related) profession. Our results highlight the need for such initiatives not only for girls, but also for boys. For example, a guest lecture of a male physician assistant or speed dates with psychologists could reduce the idea that these fields are for girls and thereby increase cross-gendered field of study choices for boys. However, one concern that was raised by the experts was that by emphasizing gender atypical fields (female scientist or male nurse), interventions could actually reinforce ideas that these fields are for girls or for boys. For example, because boys are not allowed, organizing an all-girls day in a science lab might actually reinforce the idea that it is something for boys. Similarly, in order to enhance cross-gendered choices, one intervention could be to make boys and girls aware of their different choices. One expert said that some schools in Belgium implemented a subject in the school curriculum called "educational choice", which also talked about gendered choices. However, the question remains whether raising awareness about gender differences in fields of study reduces or reinforces ideas about what is an "appropriate" field of study for boys and girls. It is therefore important to evaluate the consequences of such initiatives.

Parents play an important role in their children's educational choices and especially mothers socialize their children into gender stereotypical educational fields. Although by no means an easy undertaking, providing parents with information that diminishes their ideas that some fields are sex specific as well as make them aware that their behavior is exemplary for what is considered "appropriate" gender role behavior could reduce gender differences in fields of study. For example, the experts raised the concern that still plenty of parents think girls are just not that good in mathematics or that boys are just not that good in languages. To change these set ideas, it is important to provide parents with information that refutes the idea that innate abilities differ and that emphasizes that their sons or daughters would flourish in fields that complement their abilities and interests. Another way to change parents' ideas of what is an "appropriate" choice for their son or daughter is by providing them with general information on what certain fields of study entail. The VHTO shows there are still plenty of parents who do not support their daughter's science choices, which partly results from the fact that parents often do not have a realistic view of STEM fields and the benefits they offer (Booy et al., 2012). Making parents aware of what STEM

fields have to offer – in terms of professional opportunities or lucrative career paths – might change parents' ideas that STEM fields are an inappropriate choice for their daughter. Possible ways to reach parents are by distributing leaflets or organizing parental gatherings (at school).

Providing information about how gender norms and gendered behaviors lead boys and girls to different fields of study might also be important for other actors who are influential for adolescents' educational career, like teachers, counselors and mentors. Although we were unable to study the role of these actors, they are important socialization agents (Li, 1999; Sáinz et al., 2011). Raising awareness about their role in confirming gender role behavior could benefit cross-gendered educational choices.

Our results support the idea that interventions aimed to increase boys' and girls' participation in gender atypical fields should start early on in adolescents' educational career (Booy et al., 2012; Jansen & Joukes, 2012). Gender role socialization starts early in children's life and already affects field of study choices in secondary education. Moreover, because girls are more likely to drop out of the STEM pipeline after secondary education, it is also important to continue to invest in programs that attract and retain girls in STEM fields during secondary education. For example, using role models in gender stereotypical masculine fields during secondary education to make girls feel more comfortable with their (gender atypical) choice.

The fact that younger siblings follow their older siblings' field of study implies that when interventions meant to increase the number of individuals choosing certain fields of study target one child in the family, they may have indirect effects on that child's younger siblings (see also Brotman et al., 2005). The fact that older brothers or sisters do not influence their younger brothers or sisters differently, means that although interventions could be beneficial for attracting individuals in certain fields, they would not reduce gender segregation in educational fields

1.12 Final conclusion

This dissertation aimed to provide insight in how adolescents' social environment leads boys and girls to different fields of study. We used gender role socialization and resource theory to explain the influence of adolescents' social environment on field of study choices and have shown that both theories have their merit based on which aspect of the social environment we focus. Overall, gender role socialization theory explains how adolescents' internalized gender ideology, friends and mothers lead to gender differences in fields of study. We have shown that normative ideas of what is "appropriate" male or female behavior can prevent boys and girls from making cross-gendered educational choices, but that the consequences of these norms might be more severe for girls than for boys. We provided suggestions to tackle the persuasiveness of these gender norms in order to reduce gender differences in fields of study. We showed that resource theory seems to better explain how siblings and fathers influence field choices and concluded that siblings and fathers do not contribute to gender inequality in educational fields. Furthermore, we provided a first indication that mechanisms that lead to gender differences in fields of study might be different depending on the time point at which students make their educational choice.

Chapter 2

Boys' and girls' educational choices in secondary education. The role of internalized gender ideology*

Abstract

This study aims to explain why boys and girls in secondary education choose different educational tracks. We argue that adolescents internalize gender expectations as to what is "appropriate" male and female behavior in their gender ideology. Gender ideology can affect educational choices by influencing (1) how adolescents evaluate their competence in certain subjects (competence beliefs), (2) what they find important in a future occupation (occupational values) and (3) what school subject they prefer right now (subject preferences). Longitudinal data collected among adolescents at age 15 and 16 (N = 1062) are used. Multinomial path models show that gender ideology shapes boys' occupational values and subject preferences, whereas for girls it shapes their competence beliefs. Only for boys this leads to gender stereotypical educational choices, however. Our results support the idea that gender expectations are stricter for boys than for girls and may prevent men from entering more feminine career tracks.

Key words: Educational choices; Gender ideology; Competence beliefs; Occupational values; Subject preferences.

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2.1 Introduction

Despite the recent increase in women in higher education, men and women are still concentrated in different educational programs and occupations (Barone, 2011; Gerber & Cheung, 2008). Such gender segregation results from persisting gender differences in educational choices, which lead to different educational opportunities and labor market prospects. Educational choices already differ in early adolescence, with boys being more likely to choose mathematics and science tracks and girls tending to choose non-science tracks (Charles & Bradley, 2009; Pinxten, De Fraine, Van den Noortgate, Van Damme, & Anumendem, 2012; Van Langen et al., 2006; Van Langen, Rekers-Mombarg, & Dekkers, 2008).

To explain boys' and girls' educational choices, studies have focused mainly on gender differences in ability, with boys thought to be better at math, spatial or non-verbal activities and girls at verbal reasoning and writing. Although ability is a strong predictor for what track adolescents choose, a growing body of research shows that ability does not entirely explain how boys and girls make their educational choices (Ceci & Williams, 2011; Hyde & Mertz, 2009; Riegle-Crumb et al., 2012). Not only do girls frequently outperform boys in male-dominated areas, but when assessed purely on ability, there should be more boys in feminine tracks and more girls in masculine tracks. To explain boys' and girls' different educational choices over and above differences in ability, researchers began to focus on how gender expectations affect educational choices (Alon & DiPrete, 2015; Correll, 2004; Davis & Pearce, 2007; Hyde & Mertz, 2009). The social environment in which boys and girls grow up (i.e. peers, parents, media, school) conveys cultural beliefs about what is "appropriate" male or female behavior. Adolescents internalize these gender role expectations in their *gender ideology*. Although previous research identified gender ideology as an important explanation for why boys and girls make different educational choices, its influence is often assumed and not tested (e.g. Charles & Bradley, 2009). Additionally, the underlying mechanisms by which gender ideology might affect educational choices remain unclear. This study aims to increase our understanding of the different ways in which gender ideology (might) affect boys' and girls' educational choices.

Previous research has mainly focused on why girls are not opting for more masculine, math-intensive tracks. This study additionally evaluates why boys are not opting for more feminine tracks, which is important for at least two reasons. First, just as women are underrepresented in gender stereotypical masculine tracks (i.e. computer science and mathematics), men are underrepresented in gender stereotypical feminine educational tracks (i.e. humanities, arts and education [OECD 2009; A3.6]). Overrepresentation of men or women in educational fields can reinforce children's ideas about what is considered typical "feminine" and "masculine" behavior, which in turn underpins traditional gender role patterns and increases gender inequality (Geerdink et al., 2011). Second, whereas women who choose masculine fields are viewed as moving up the ladder, the opposite is true for men entering feminine fields. Men working in non-traditional occupations often find their male identity, sexuality and ability to "compete in a man's world" being challenged (Perra & Ruspini, 2013). More understanding of gendered and cross-gendered choices might lower the barrier for men to enter female-dominated fields.

This study focuses on students in upper secondary education in the Netherlands. At the end of their third year of upper secondary education (15 years old), Dutch adolescents choose to continue in one of four tracks that vary in math intensity and core subjects: Science & Technology, with a focus on pure mathematics, chemistry and physics; Science & Health, with a focus on physics and biology; Economics & Society, with a focus on economics and history; and Culture & Society, with a focus on modern languages and humanities. Science & Technology is the most math-intense and teaches mathematics at the most advanced level, followed by Science & Health, Economics & Society and Culture & Society. The educational track that they choose affects adolescents' options after secondary education. For example, if they wish to study science in higher education, they must complete a science track in secondary education. The Netherlands is a special case because, unlike other countries (e.g. Sweden; Van Langen & Dekkers, 2005) where it is relatively easy to get back on a science track at a later point, the choices Dutch students make in secondary school are more or less final, and a "wrong" choice is hard to reverse. This highlights the importance of evaluating how educational choices are made during secondary education.

In sum, this study focuses on how gender ideology affects boys' and girls' educational track choice in secondary education in the Netherlands. We contribute by testing the effect of gender ideology on boys' and girls' educational choices, and by unravelling the different ways in which it might do so. Moreover, our focus lies not only on why girls are not opting for more masculine tracks, but also on why boys are not opting for more feminine tracks.

2.2 Theory

In traditional gender role expectations, men are expected to be breadwinners and women homemakers and caregivers (Davis & Greenstein, 2009). Likewise, men are supposed to be more rational and mathematical and women more nurturing and verbal (Jacobs et al., 2002; Parsons & Bales, 1955). According to gender socialization theories (Fagot, Rodgers, & Leinbach, 2000), adolescents internalize these gender role expectations in their gender ideology and conform to the behavioral prescriptions of their gender category because doing so confirms their identity (Akerlof & Kranton, 2000; Sinclair & Carlsson, 2013). Similarly, not conforming to internalized gender role expectations leads to uncertainty and guilt, which they will try to avoid. Because adolescents are still shaping their gender identity, they are very likely to conform to gender roles (Galambos et al., 1990). The more boys and girls have internalized a traditional gender ideology, the more they will make masculine or feminine educational choices, respectively. Below, we evaluate three important ways in which gender ideology can affect educational choices. Figure 2.1 summarizes our theoretical model.

First, gender ideology can affect educational choices by influencing how boys and girls evaluate their competence in a certain area (Correll, 2004; Wigfield & Eccles, 2000). Research shows that, in keeping with traditional gender norms, boys have more confidence in their math or science ability than girls (Correll, 2004; Crombie et al., 2005; Sikora & Pokropek, 2012), who often evaluate their competence in reading, language and social activities more positively (Chow & Salmela-Aro, 2011; Jacobs et al., 2002). Sikora and Propopek's (2012) study of 15-year-old adolescents in 50 countries shows that in almost each country, boys have more confidence than

girls in their science ability, even after actual science ability is taken into account. It also shows that students who have a positive view of their science ability are more likely to consider a career in science. Other studies have identified these achievement-related competence beliefs as important predictors for educational choices (Crombie et al., 2005; Osborne et al., 2003; Wigfield & Eccles, 2000). We would expect that students who have a positive opinion of their verbal or mathematical competence will be more likely to choose a more feminine or masculine educational track, respectively. In sum, we expect that *boys and girls with a more traditional gender ideology have more traditional competence beliefs and will therefore choose more traditional gender stereotypical educational tracks (H1).*

The second way in which gender ideology can steer boys and girls towards different educational tracks is by influencing what they value in a future occupation. Research has shown that women value working with people and emphasize social and altruistic values in their ideal job, whereas men like to work with things and value economic wealth, prestige and status (Diekman et al., 2010; Su et al., 2009). These results concur with traditional gender ideology, in which men are supposed to be breadwinners and women are supposed to be caregivers. We thus expect that when boys and girls have a more traditional gender ideology, boys will have more traditional masculine occupational values (e.g. valuing income and status in a future job) and girls will have more traditional feminine occupational values (e.g. valuing helping others and working with people in a future job). In turn, these occupational values influence what types of skills they seek to learn in the course of their education. Research shows that what people want in the future, including their occupational values, can be a powerful predictor of the field they choose (Beal & Crockett, 2010; Diekman et al., 2010). Boys who have traditional values would tend to go into economic, science or mathematics tracks, as these generally provide a higher status and more income, whereas girls would be inclined to focus on more social and people-oriented tracks. We expect that *boys and girls with a more traditional gender ideology have more traditional occupational values and will therefore choose more traditional gender stereotypical educational tracks (H2).*

The third way in which gender ideology might affect educational choices is by influencing academic subject preferences. Traditionally, more science-related subjects, for example mathematics and information technology, are considered masculine subjects, whereas art, language and humanities are typical feminine subjects (Colley & Comber, 2003; Whitehead, 1996). If boys and girls choose according to their gender ideology, they will be more likely to have more masculine and feminine subject preferences, respectively. However, research on gender differences in subject preferences has not been unanimous. Colley and Comber (2003) concluded that, although some preferences change over time, there are persisting gender differences in subject preferences. Their research among 15-to16-year-old adolescents shows that boys tend to prefer math as well as physical education and information and communication technology, whereas girls are more likely to prefer drama, English, geography and art. However, other research suggests that the gender gap in the subject preferences of adolescents (of similar age) is narrowing, with traditional patterns persisting in subjects liked least, but not in favorite subjects (Francis, 2000). Still others found no significant gender differences in subject preferences for children aged 8, 12 and 16 (Miller & Budd, 1999). Researchers have identified liking or enjoying a task or a subject as an important predictor for what educational track students choose (Elsworth & Harvey-Beavis, 1999; Lyons, 2006; Van Langen et al., 2006). More feminine or masculine subject preferences should therefore lead to more feminine or masculine track choices. To summarize, we expect that *boys and girls with a more traditional*

gender ideology have more traditional subject preferences and will therefore choose more traditional gender stereotypical educational tracks (H3).

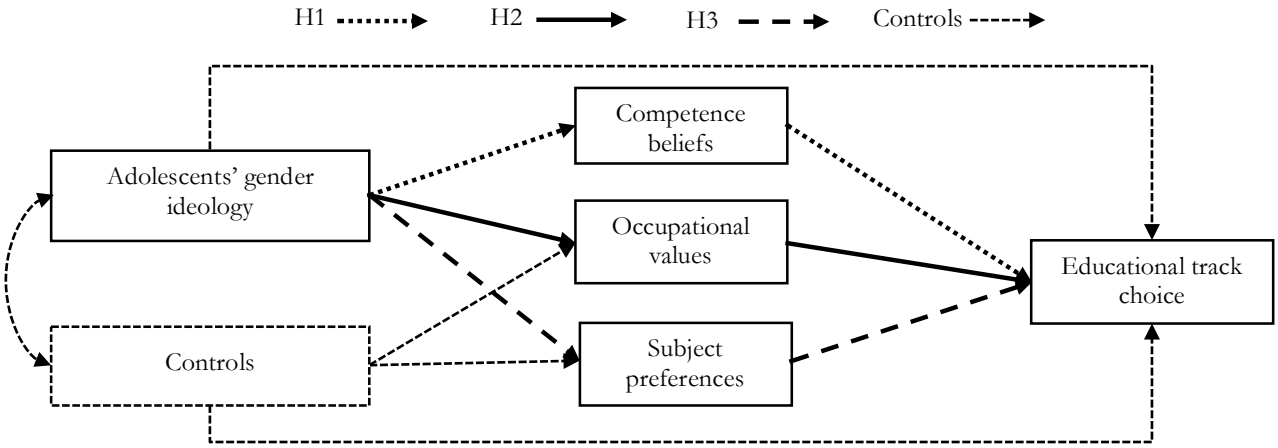

Figure 2.1 Theoretical model.

2.3 Method

The Dutch education system

After primary education (age 12), students in the Netherlands can enter three levels of secondary education, depending on their grades and test results in primary education. Unlike the lowest level of secondary education (vocational level, VMBO, 4 years), the two highest levels (general level, HAVO, 5 years and academic level, VWO, 6 years) give access to tertiary education. Students who enter the vocational level make their track choices at the end of grade 7 (age 13–14; second year of secondary school), while students who enter the general level and academic level make their track choices at the end of the 8th grade (age 14–15; third year of secondary school). Since our data were collected when the respondents were in grade 8 (first wave) and grade 9 (second wave), students at the vocational level already made a track choice at T1 and were therefore excluded from our study. Of all respondents who participated in both waves, 37% attended the general or academic level. Our dependent variable, track choice, was measured at the second point in time, along with competence beliefs, occupational values and subject preferences. Gender ideology and all control variables were measured at the first point in time.

Data and sample

Our data-set is taken from the Children of Immigrants Longitudinal Survey in Four European Countries (CILS4EU; Kalter et al., 2014). Funded by NORFACE (New Opportunities for Research Funding Agency Co-Operation in Europe), this project was set up to explore the structural, cultural, and social integration of immigrant and non-immigrant children in Germany, the Netherlands, Sweden and the United Kingdom. The present study uses data collected in the Netherlands in 2010/2011 (wave 1) and 2011/2012 (wave 2).

Respondents were selected using a three-stage sample design stratified according to educational level and percentage of non-Western immigrants in a school. First, schools were randomly chosen, with an oversampling of schools with higher proportions of immigrant children.

Very small schools were excluded, as well as schools for mentally and physically disabled children or children with a learning disability (school level exclusion = 6.8%). To increase the response rate among schools (34.9%), non-responding schools were replaced with other similar schools, leading to a school participation rate of 91.7%. Within schools, two school classes were randomly selected (class level participation rate = 94.5%) and all students in these classes were surveyed (student level participation rate = 91.1%).

In total, 4363 children were surveyed in 222 classes at 100 schools, of whom 3211 (73.6%) also participated in school in the second wave. Of these, 1196 (37.3%) respondents are in the upper two levels of secondary education (general and academic level). After excluding respondents with missing data, we analyzed 1062 respondents at 36 schools.

Measures

Dependent variable

Educational track reflects the educational track choice made by upper level secondary school students. The options are Science & Technology, Science & Health, Economics & Society, and Culture & Society. In total, 93 adolescents had chosen both Science & Technology and Science & Health and 19 adolescents had chosen both Economics & Society and Culture & Society. This is because, although each track focuses on some core subjects, students are allowed to customize tracks and take courses from other tracks. For example, a student can choose the Economics & Society track but also study French, which is part of the Culture & Society track. Students who had chosen two tracks were assigned the track that is more science and math-intense (i.e. combined Culture & Society and Economics & Society were recoded as Economics & Society, and combined Science & Technology and Science & Health was recoded as Science & Technology).[1]

In our data, 38% of the adolescents enrolled in the Science & Technology track are girls, compared to 66% in Science & Health, 52% in Economics & Society, and 87% in Culture & Society. National statistics from the Netherlands report similar figures for 2011/2012, with girls representing 23% of adolescents enrolled in the Science & Technology track, 62% in Science & Health, 46% in Economics & Society and 81% in Culture & Society (Statistics Netherlands 2014). Based on these statistics, Science & Technology can be considered the most masculine choice, followed by Economics & Society, Science & Health, and Culture & Society.

Independent variables

Traditional gender ideology reflects the extent to which people identify with family roles traditionally linked to gender. A common way to measure gender ideology is to ask respondents who should bear more responsibility for certain tasks (Davis and Greenstein 2009). In our case, the tasks were as follows: (1) take care of the children, (2) cook, (3) earn money and (4) clean the house. The response categories were as follows: "mostly the man"; "mostly the woman"; and "both about the same". For the caretaking item, cooking and cleaning, students received a score of 2 when they responded "mostly the woman," 1 when they responded "both about the same," and 0 when they responded "mostly the man." For the item on income, students received a score of 2 when they

[1] We ran all analyses again leaving out these respondents and coding the 19 and 93 adolescents as enrolled in Culture & Society and Science & Health, respectively. The results were very similar.

responded "mostly the man," 1 when they responded "both about the same," and 0 when they responded "mostly the woman." Averaging these items resulted in a scale (Chronbach's $\alpha = 0.67$) that ranges from 0.5 to 2, with higher scores indicating a more traditional gender ideology.

Competence beliefs consist of *verbal competence* beliefs and *mathematics competence* beliefs. Students were asked: How good are you in the following subjects? Math, English, and Dutch. Response categories were "not good at all" (0) to "very good" (4). For verbal competence, we averaged the scores for English and Dutch. Competence beliefs thus reflect how good adolescents thought themselves to be in mathematics as well as reading, writing and speaking English or Dutch. Higher scores indicated a more positive evaluation of the student's competence beliefs.

Occupational values reflect what adolescents consider important in a future job. Using a four-point scale ranging from "not at all important" (0) to "very important" (3), the respondents indicated how important they think the following is in a future occupation: "Helping people" and "Having a high income". The items represent gender stereotypical feminine or masculine occupational values. Theoretically, helping people fits the feminine gender role, whereas having a high income fits the breadwinner gender role. We added both variables separately in the analyses as *helping others* and *income*.

Feminine subject preference was measured by asking "What is your favorite subject?". The answers were coded into fields of study based on the International Standard Classification of Education Scale (ISCED97; UNESCO, 2006). These are field of study options in tertiary education. To indicate the masculinity or femininity of adolescents' subject preferences, we extracted the percentage of women enrolled in these fields of study in the Netherlands in 2012 (the same year as the survey), based on data collected by Statistics Netherlands (Netherlands, 2014). In total, we classified school subjects into 24 fields (see appendix A, table A.1 for the coding of the specific fields), with the percentage of female enrolment ranging from 13.48 (physics) to 81.23% (French). Higher scores indicate more feminine subject preferences.

Controls

We controlled for ability because it is not only a powerful predictor for what track an adolescent might follow but is also likely to be linked to competence beliefs, occupational values and subject preferences. Ability was measured by both verbal and nonverbal cognitive tests. The *verbal ability* test is a measure of Dutch language abilities. Respondents were asked to find synonyms for 30 words on a list of 5 response options ("Synoniemen" from the "Nederlandse Intelligentietest voor onderwijsniveau"; NIO [Van Dijk & Tellegen, 2004]). This resulted in 30 items indicating whether the respondent answered the question correctly (1) or not (0). A sum scale with a Kuder-Richardson coefficient of reliability (suitable for binary data) of 0.69 was calculated. Nonverbal *cognitive ability* was measured with a standard cognitive ability test (CFT20R, "Grundintelligenztest Skala 2 Revision"; [Weiß, 2006]) based on graph problems and therefore considered language-free and "culturally fair". In these measures, a sum scale with Kuder-Richardson reliability of 0.62 was created from 27 items indicating whether the graph problems were solved correctly (1) or not (0).

We controlled for socioeconomic status (SES) because having a higher SES increases a student's uptake in mathematics and science tracks (Van de Werfhorst et al., 2003). As an indication of high SES, we use *highest parental occupational status* and *highest parental education* as reported by the parent. Parents were given the questionnaire in the first wave. If they did not respond, they were

sent a reminder and ultimately contacted by phone if possible (response rate parents' questionnaire: 74.7%). Parents were asked about their current and last occupation and their main activities in this occupation, as well as that of their partners (if present). Their occupations were coded according to the International Standard Classification of Occupations 2008 (ISCO08). We used conversion tools (Ganzeboom & Treiman, 2010) to recode the ISCO08 into the standard International Socio-Economic Index of occupational status scores (ISEI). If we had information on both parents, we took the current or last occupation with the highest status (n = 668). When respondents lived with one parent, we used only one parent's current or last occupational status (n = 145). As not all parents completed the questionnaire, the remaining missing values were replaced with information provided by the adolescents, who also answered questions about their parents' main occupation. However, adolescents reported this information specifically for their biological parents. We therefore only replaced missing parental occupational status scores if the respondent indicated that (s)he lived with both biological parents (n = 231), or only their biological mother or biological father (n = 18). The scores for highest parental occupational status range from 12.34 to 88.96, with higher scores indicating higher occupational status.

Highest parental education reflects the highest educational level attained within a couple. The parent was asked to indicate the highest educational level that he/she and his/her partner had attained. We took the maximum educational level attained either within the couple (n = 688) or by only one parent (n = 243). This resulted in a measure with 6 categories: no education (0), primary education (1), secondary education (2), intermediate vocational education (3), higher vocational education (4) and university (5). We again replaced missing values with information provided by the adolescent. Adolescents were asked about their biological mothers' and fathers' highest education. We replaced parental missing values if the respondent lived with both biological parents (n = 113) or only the biological mother or the biological father (n = 18).

We controlled for whether adolescents live with both biological parents or not because field of study choices can vary by household type (Brolin Låftman, 2008; Murray & Sandqvist, 1990). *Intact family* indicates whether a child lives with both biological parents (1) in wave 1. The reference category is all other living arrangements (0).

To control for differences between the two upper secondary educational levels, we constructed the variable *academic level*, which indicated whether students are on the general level (0) or on the academic level (1) in wave 1.

Lastly, because the data contains an oversampling of immigrant adolescents, we controlled for the immigrant background of adolescents. If an adolescent, or at least one of the parents, was born abroad, we consider the pupil to have an *immigrant* background (1), whereas if both parents were born in the Netherlands, we consider the adolescent part of the native group (0). Table 2.1 shows the descriptive statistics for all respondents and for boys and girls separately.

Table 2.1 *Descriptive statistics for boys (n = 468) and girls (n = 594).*

	M			SD		
	Total	Boys	Girls	Total	Boys	Girls
Dependent variable						
Science & Technology (0-1)	0.23	0.33	0.16			
Economics & Society (0-1)	0.43	0.47	0.40			
Science & Health (0-1)	0.22	0.17	0.25			
Culture & Society (0-1)	0.12	0.04	0.19			
Independent variables						
Traditional gender ideology (0.5-2)	1.37	1.45	1.31	0.35	0.36	0.34
Competence beliefs						
Verbal competence (0-4)	2.46	2.48	2.45	0.73	0.71	0.74
Mathematical competence (0-4)	2.29	2.42	2.18	1.03	0.96	1.07
Occupational values						
Helping others (0-3)	1.97	1.76	2.13	0.66	0.69	0.59
Income (0-3)	2.14	2.26	2.05	0.55	0.55	0.52
Feminine subject preferences (13-81)	42.52	35.52	48.04	17.19	14.05	17.43
Controls						
Verbal ability (0-30)	19.87	20.25	19.57	3.91	3.68	4.06
Cognitive ability (4-27)	21.48	21.34	21.59	3.04	3.27	2.84
Parental SES						
Highest occupational status parents (12-89)	60.58	61.05	60.21	18.49	18.22	18.71
Highest educational level parents (0-5)	3.48	3.48	3.47	1.13	1.14	1.13
Intact family (0-1)	0.83	0.85	0.81			
Immigrant (0-1)	0.23	0.23	0.23			
Academic level (0-1)	0.58	0.56	0.60			

Source: Wave 1 and wave 2 of Children of Immigrants Longitudinal Survey in Four European Countries.
Note: For categorical variables, proportions are given.

2.4 Analyses

We performed multinomial path analyses in STATA to test our hypotheses. These analyses give odds ratios, which are difficult to interpret due to unobserved heterogeneity (Mood, 2010). We therefore calculated average marginal effects. Marginal effects indicate the change in the probability of an adolescent choosing a track for every one-unit change in an explanatory variable. These marginal effects were estimated for every individual in our data and subsequently averaged and multiplied by 100. This allows us to say how much more or less likely it is (in percentages) that an adolescent will choose a particular track for every one-unit increase in an explanatory variable. Standard errors were bootstrapped from 1000 sampling distributions. Since our data are hierarchically structured (students are nested within classes and schools), standard errors were adjusted to take into account the non-independence of our data. Classes in grade 4 of upper secondary education in the Netherlands differ considerably from those in grade 3 because in grade 4, students are grouped together according to their chosen track. We therefore controlled for

clustering of adolescents at school level (n = 36 schools), and not at class level. To assess model fit, we used generalized Hosmer and Lemeshow goodness-of-fit, which is appropriate for a multinomial logistic regression model (Fagerland & Hosmer, 2012). The observations are ordered by expected probabilities and subsequently grouped into 10 groups. A Chi^2 then calculates the difference between the observed and predicted values and a non-significant p-value means that the observed values and the model-predicted values do not differ from each other, indicating a good fit. The model fit statistics presented are not controlled for clustering, because this is not yet available.

We conducted our analyses separately for boys and girls because a traditional gender ideology means something different for each group.

As illustrated in Figure 2.1, our model consists of direct and indirect effects. Our interest lies in the indirect effects of gender ideology, as we have argued that adolescents with more traditional gender ideologies make more traditional educational choices because they have more traditional competence beliefs (H1), more traditional occupational values (H2) and more traditional subject preferences (H3). For practical reasons, we only display significant effects of gender ideology for boys (Figure 2.2) and girls (Figure 2.3). All other effects can be found in Appendix A (i.e., all significant and non-significant effects of gender ideology and mediators on track choices: table A.2 and A.3; overall indirect effects: table A.4; and direct effects of all variables: table A.5). As our mediators are continuous variables, the effects of gender ideology on the mediators are interpretable as regular regression coefficients. The effects of competence beliefs, occupational values and subject preferences on the dependent variable track choice are average marginal effects (×100).

2.5 Results

Figure 2.2 shows the results for boys. The goodness of fit tests indicates that the observed and predicted models do not significantly differ from each other, indicating a good model fit (p = 0.79). Figure 2.2 shows that gender ideology does not affect boys' competence beliefs, refuting hypothesis 1 for boys. Competence beliefs do affect boys' educational track choices. When boys evaluate their verbal skills more positively (by one point), they are on average 6.40% less likely to choose Science & Technology. However, verbal competence does not affect the likelihood of their choosing other tracks. When boys evaluate their math skills to be better (by one point), they are on average 14.30% more likely to choose the Science & Technology track, 8.67% less likely to choose the Economics & Society track and 2.86% less likely to choose the Culture & Society track. When boys' competence beliefs in math are more positive, they are thus more likely to choose the most scientific, math-intense track. Notably, the likelihood of their choosing the Science & Health track – which is more math-intense than the Economics & Society and Culture & Society tracks – is not affected.

The results partly confirm hypothesis 2 for boys. Boys with a more traditional gender ideology have more traditional occupational values because they value income more (b = 0.20, p < 0.05) and helping others less in a future occupation (b = −0.26, p < 0.01). However, having more

traditional values only partly leads to more traditional educational choices for boys. Boys who value helping others in a future occupation are 6.35% more likely to choose the Science & Health track.

Hypothesis 3 is also partly supported for boys. Boys with a more traditional gender ideology have less feminine subject preferences ($b = -3.68$, $p < 0.05$). With every percentage increase in the feminine nature of boys' subject preferences, boys are on average 0.39% less likely to choose Science & Technology, 0.27% more likely to choose Science & Health and 0.12% more likely to choose Culture & Society. Subject preferences do not affect the likelihood of choosing Economics & Society.

Figure 2.3 displays the results for girls. The goodness-of-fit tests indicate that the observed and predicted model do not significantly differ from each other, indicating a good model fit ($p = 0.08$). Contrary to hypothesis 1, Figure 2.3 shows that for girls having a more traditional gender ideology leads to lower verbal competence beliefs ($b = -0.18$, $p < 0.01$). For every point increase in how girls evaluate their competence in languages, they are on average 6.60% less likely to choose the Science & Technology track and 6.20% more likely to choose the Culture & Society track. Gender ideology does not affect competence beliefs in math. However, for every point increase in mathematical competence, girls' likelihood of choosing Science & Technology increases on average by 12.31% and the probability of their choosing Culture & Society decreases on average by 10.04%.

Gender ideology does not affect occupational values or subject preferences, meaning we find no support for hypothesis 2 and 3 for girls. Results do show that if girls value helping others more (by one unit), they are on average 8.38% less likely to choose the Economics & Society track. If they have less traditional occupational values (value income more), they are 9.99% more likely to choose the Economics & Society track. For subject preferences, we find that for every percent increase in the feminine nature of girls' subject preferences, girls are on average 0.23% less likely to choose the Science & Health track and 0.29% more likely to choose the Economics & Society track.

The overall indirect effects of gender ideology on track choice via competence beliefs, occupational values and subject preferences were not significant for either sex (see table A.3 Appendix A). This is most likely due to too few respondents in our data, in particular given the complex nature of our model.

We additionally tested the direct effect of gender ideology on educational choice (see table A.4, Appendix A). This direct effect was not significant, meaning that gender ideology has no remaining effects on educational choice that are not explained by our mediators.

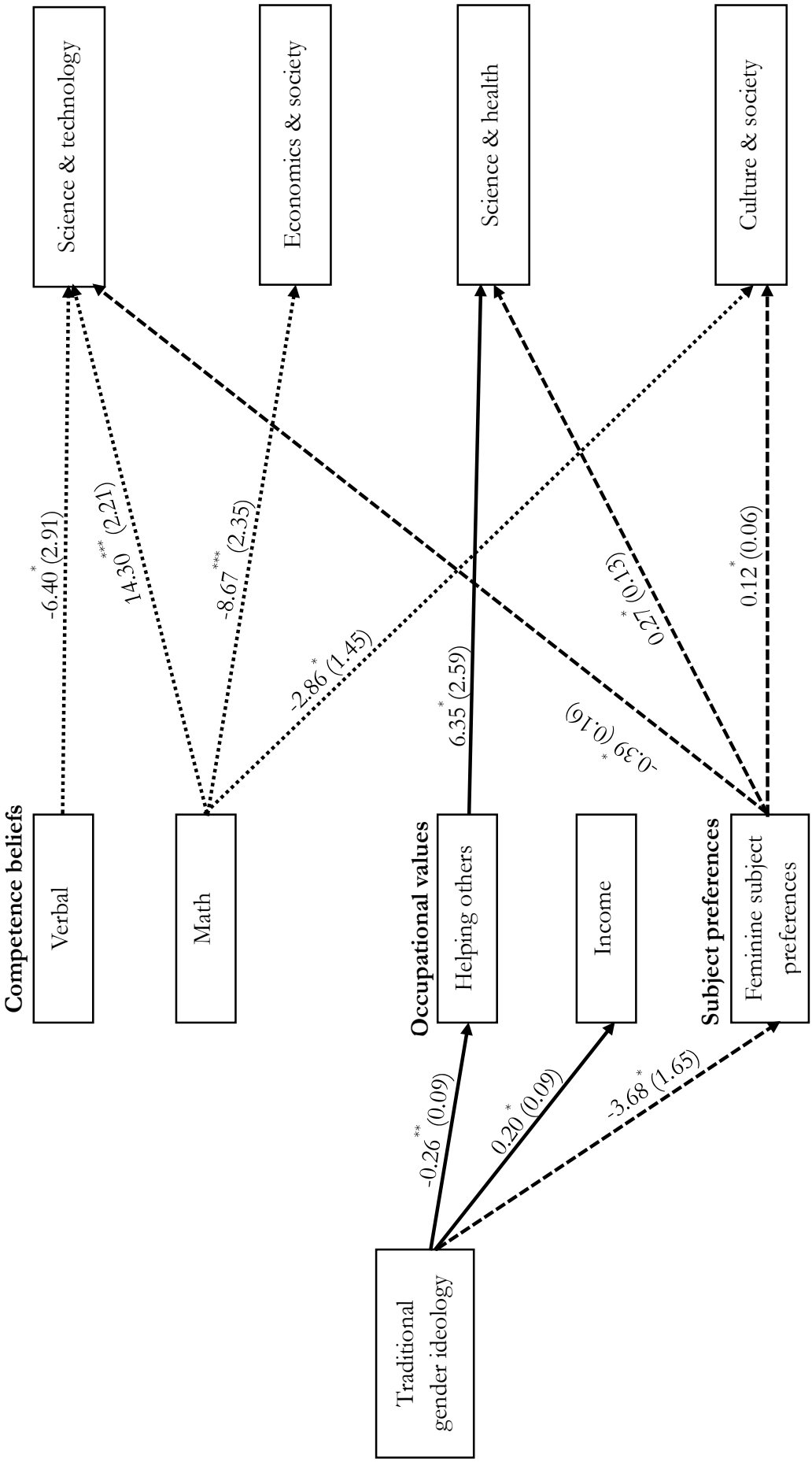

Figure 2.2 Results for boys. The direct effects of gender ideology on mediators (regular regression coefficients) and of mediators on educational track choice (average marginal effects × 100). Results are controlled for: cognitive ability; verbal ability; highest parental occupational status; highest parental education; household type (1 = intact family); level of secondary education (1 = academic level); ethnicity (1 = minority); $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$ (two-tailed test).

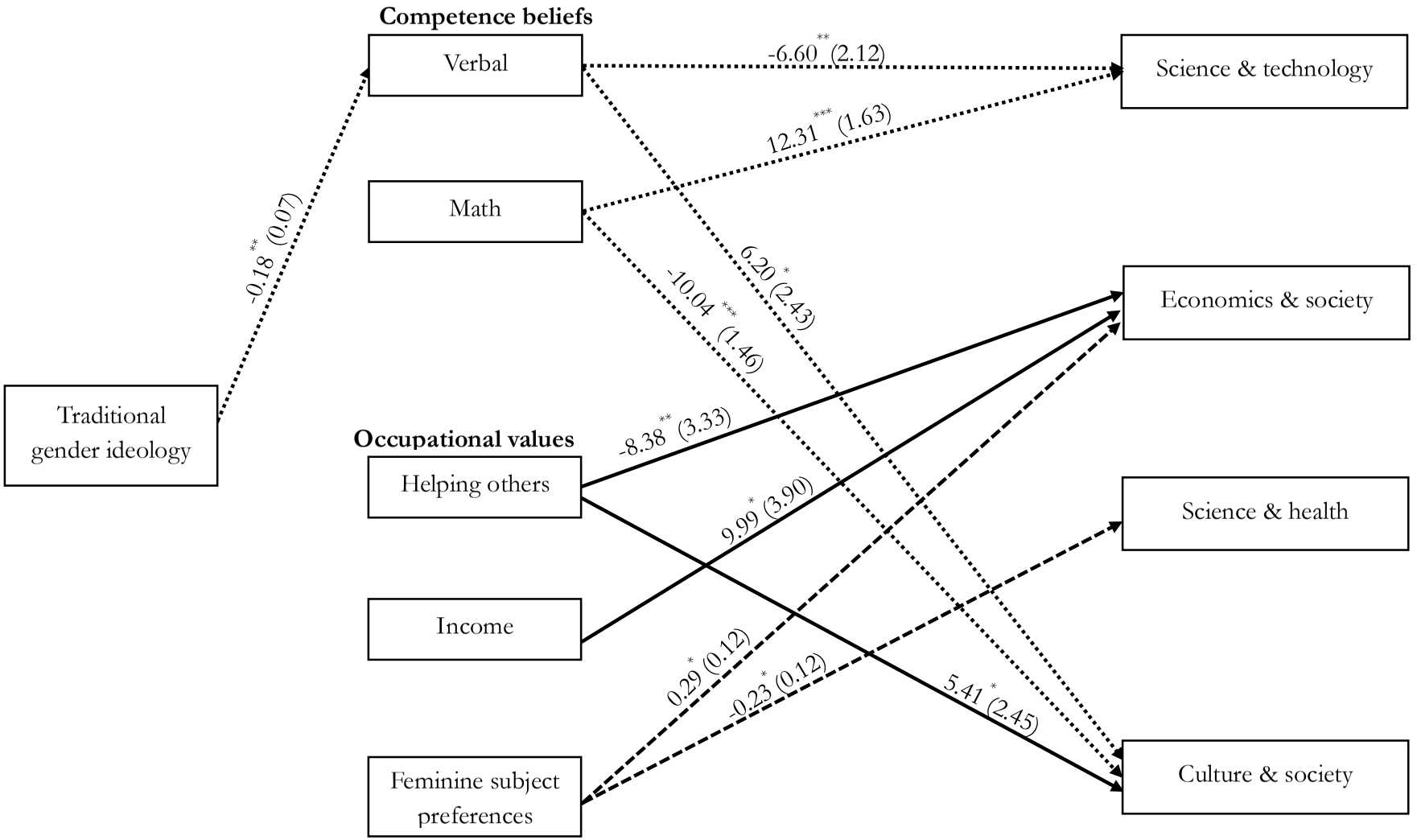

Figure 2.3 Results for girls. The direct effects of gender ideology on mediators (regular regression coefficients) and of mediators on educational track choice (average marginal effects × 100). Results are controlled for: cognitive ability; verbal ability; highest parental occupational status; highest parental education; household type (1 = intact family); level of secondary education (1 = academic level); ethnicity (1 = minority); $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$ (two-tailed test).

2.6 Conclusion and discussion

This study evaluated how adolescents' gender ideology affects educational choices via competence beliefs, occupational values and subject preferences in upper secondary education in the Netherlands. We considered not only why girls are not opting for more masculine tracks, but also why boys are not choosing more feminine ones. We argued that adolescents with a more traditional gender ideology have more traditional competence beliefs, occupational values and subject preferences, leading them to make more gender stereotypical educational track choices. Using two waves of the CILS4EU data, we analyzed 1062 students using multinomial path analyses.

Results show that a more traditional gender ideology leads to more traditional occupational values for boys, but not girls. In line with the breadwinner ideology, boys with a more traditional gender ideology value having a high income in a future occupation and find helping others less important. These gender stereotypical traditional values only partially affect educational choices. Boys, who value helping others in a future occupation, are more likely to opt for a track with a focus on biology and physics (Science & Health). This finding is consistent with previous research suggesting that the domain of health and biology can be categorized as more social and people-oriented, which are often considered more feminine (Sikora & Pokropek, 2012). Boys who have a more traditional gender ideology find helping others less important in a future job, and shy away from this domain.

Gender ideology also affects boys' subject preferences, but not those of girls. Boys with a more traditional gender ideology have more masculine subject preferences. Consequently, they are more likely to enter a more masculine track with a focus on pure science (Science & Technology) and less likely to choose the more feminine tracks that focus on biology and physics (Science & Health) and languages and humanities (Culture & Society). The fact that gender ideology affects boys' values and preferences and not girls' highlights the importance of studying not only why girls are not making masculine educational choices, but also why boys are not opting for more feminine tracks.

Our results show that gender expectations steer boys into educational tracks because they affect what boys prefer to do right now and what they find important in the future. Gender ideology thus partly explains why boys are not choosing more feminine educational tracks and it is therefore important to take that ideology into account when studying boys' educational choices. Our results also show that, although they are not affected by gender ideology, girls with more feminine subject preferences are more likely to choose an economic track (Economics & Society) and less likely to choose a track that focuses on physics and biology (Science & Health). Even though Science & Health can be considered more feminine because it involves biology (i.e. social and people-oriented), girls with more feminine preferences still shy away from this science-oriented track. However, feminine preferences do lead girls to choose Economics & Society. One argument could be that girls choose this track because it also involves the humanities (e.g. history). Nevertheless, girls with more feminine subject preferences are not more likely to choose the Culture & Society track, which focuses on the humanities and modern languages. Our results suggest that science remains a more masculine option for girls, but that economics is not incompatible with feminine preferences. This suggests that economics is no longer perceived as a typically masculine domain

and fits in with the rising number of women entering business or the growing acceptance of women making "masculine" field choices (England & Li, 2006).

Contrary to our expectations, a more traditional gender ideology leads girls to evaluate their verbal competence more negatively. They are subsequently less likely to choose a gender stereotypical feminine track (Culture & Society) and more likely to choose a gender stereotypical masculine track (Science & Technology). One explanation could be that it is not just that more traditional girls evaluate their competence more negatively, but that girls who are more traditional believe that they should be really good at languages and thus underestimate their competence. However, our result could also be due to our measurement of gender ideology. Girls with a traditional gender ideology may identify with the caregiver/homemaker role. Although care giving and verbal competence are both considered feminine, they may in fact be two separate domains. Measuring competence beliefs in care giving might reveal more about how gender ideology affects educational choices.

Gender ideology was not related to girls' mathematical competence beliefs or to boys' mathematical competence beliefs. These results are in line with recent research indicating that gender stereotypes associated with math and language are changing. Boys and girls still view language as a typically feminine domain, whereas they no longer regard mathematics as a typically masculine domain (Kurtz-Costes et al., 2014; Plante et al., 2009). If mathematics is becoming more gender neutral, then it would not fit in with either male or female gender ideology, thus explaining why we did not find that gender ideology affects boys' or girls' mathematical competence beliefs.

This study is one of the few to look specifically at the verbal competence beliefs of boys and girls. Previous literature focused mainly on mathematical/science competence beliefs (e.g. Crombie et al., 2005) or on gender differences in competence beliefs (e.g. Jacobs et al., 2002). Verbal competence is a more interesting research subject than mathematical competence, however. In the first place because our findings indicate that gender expectations lead girls to evaluate their verbal competence negatively, irrespective of their actual verbal ability, and second because although attitudes towards mathematics are becoming more gender neutral, that might not be the case for verbal competence.

In sum, gender ideology influences boys' educational choices because it affects what they consider important in the future as well as what they enjoy doing right now, leading to more gender stereotypical educational choices. In the case of girls, gender ideology affects how they evaluate their verbal competence. Our results support the idea that gender expectations are stricter for boys than for girls. Whereas it is increasingly acceptable for girls to make more masculine choices, there is less acceptance of cross-gendered choices for boys (Kane, 2006; Perra & Ruspini, 2013). Future research should further examine the role of gender ideology in explaining boys' educational choices, as this may help explain why boys are not choosing more traditional feminine tracks.

The findings of this study should be viewed within the context of its limitations. Owing to data limitations, our dependent and mediator variables were measured at the same point in time (second wave), making it impossible to infer causal claims on the relationship between competence beliefs, occupational values, subject preferences and educational track choice. However, gender ideology was measured at an earlier time point, which supports our conclusion that gender ideology affects competence beliefs, occupational values and subject preferences. Additionally, although some constructs (e.g. ability) are precisely measured, we measured other concepts with a single

item. More elaborate measures would contribute to the stability of our results. Lastly, the indirect effect of gender ideology on educational choices via all three mediators was not significant, most likely due to having too few respondents in our data. Replication of our study using a larger sample of adolescents could reveal more effects.

Despite these limitations, gender ideology is an important concept in shaping boys' and girls' competence beliefs, occupational values and subject preferences, and it affects boys and girls in different ways. We recommend that future research examines the effect of gender expectations on the educational choices of boys and girls. Not only does this effect remain under-examined, but it is important to understand why boys and girl continue to make different educational choices because such choices affect their future educational and occupational careers. If talented individuals are choosing to do what is socially desirable, rather than doing what they do best, society might very well be missing out.

Chapter 3

Intergenerational transmission of gender segregation. How family characteristics affect gender differences in field of study choices*

Abstract

The study explores how family characteristics lead to gender differences in educational fields. We argue that adolescents enter fields similar to those of their parents because of intergenerational transmission of occupation-specific resources or because adolescents learn gender role behavior from them. We examine how parents' occupational field affects boys' and girls' field of study choices and evaluate gender differences in fields of study between adolescents from mother-only households and two-parent households. We use longitudinal data collected from adolescents and their parents in the Netherlands (N =2812). Results show that especially mothers' feminine occupational field leads adolescents to more gender stereotypical fields of study. These effects do not differ across household types. This study highlights the role of horizontal characteristics when examining adolescents' field of study choices and concludes that, contrary to the stratification literature, which primarily focuses on fathers, mothers play a more important role in gender differences in fields of study.

Key words: Parents' occupational field, Household type, Field of study, Gender differences.

* This chapter is currently under review at an international journal. This chapter is co-authored by dr. Eva Jaspers, prof. dr. Ineke Maas and prof. dr. ir. Tanja van der Lippe. Van der Vleuten wrote the main part of the manuscript and conducted the analyses. Jaspers, Maas and Van der Lippe substantially contributed to the manuscript. The authors jointly developed the idea and design of the study. An earlier version of this chapter was presented at the annual Research Committee on Stratification (RC28) meeting (Tilburg, The Netherlands, 2015) and the conference "(Persistent) Inequalities Reconsidered: Education and Social Mobility" (Monte Verita, Switzerland, 2015).

3.1 Introduction

Boys and girls are still segregated into different occupational fields, partly owing to persistent gender differences in fields of study. Boys are more likely to enter gender stereotypical masculine fields of study such as engineering and mathematics, whereas girls are more likely to enter gender stereotypical feminine fields such as the humanities and arts (OECD, 2009: table A3.6). Although there are many factors that can influence gender differences in fields of study (Xie et al., 2015), one factor shown to have an important influence on adolescents' educational career is the family (Buchmann & Hannum, 2001). To explain gender differences in fields of study, previous research looked at the influence of parents' social class and educational background, which are vertical characteristics because they focus on differences in *level* (Davies & Guppy, 1997; Van de Werfhorst et al., 2000, 2003). Only a few studies highlight the importance of linking horizontal positions (i.e., parents' occupational field) to adolescent's field of study choice (Dryler, 1998; Van de Werfhorst & Luijkx, 2010). Moreover, parents' influence might differ depending on the parent with whom an adolescent lives (Brolin Låftman, 2008). The present study aims to explain how parents' horizontal characteristics lead boys and girls to masculine (male-dominated) and feminine (female-dominated) fields of study after secondary education, and evaluates how these influences differ between household types.

This chapter makes a contribution to the existing literature by contrasting two explanations for how parents might influence their children's field of study. Although it seems plausible that adolescents enter fields similar to those of their parents, the different ways in which children learn from their parents generate different expectations as to what fields of study boys and girls enter. The first explanation is based on the theory of *direct transfer* and entails that adolescents enter a similar field of study as their parents' occupational field because parents transfer occupational field-specific resources (e.g., like information, skills, but also aspirations) to their children (Jonsson et al., 2009). Studies show that there is intergenerational resemblance between a father's occupational field and both his son's and his daughter's field of study (Van de Werfhorst et al., 2001; Van de Werfhorst & Luijkx, 2010). However, only a few studies have looked at the effect of mother's occupation in addition to father's on their children's field of study, with mixed results. There is some support for direct transfer (Dryler, 1998), but other studies show that the relationship between parents' occupational field and adolescent's field of study is not so straightforward (Leppel et al., 2001; Støren & Arnesen, 2007).

The second explanation is called *gender role socialization* theory and entails that boys and girls learn "appropriate" male and female gender role behavior by watching their parents' behavior. In this explanation, mother's and father's behavior functions as an example of what adolescents consider "appropriate" female or male gender role behavior. The few studies that test how gender role socialization theory affects boys' and girls' educational decisions found support for this explanation for boys, but not for girls (Dryler, 1998; Støren & Arnesen, 2007).

Including both mothers and fathers and boys and girls in the underlying study allows us to explore whether direct transfer or gender role socialization theory is more important for the intergenerational transmission of horizontal characteristics. Furthermore, it enables us to study how parents' influence might differ for boys and girls as well as which parent has a greater influence on which field of study adolescents enter.

Both direct transfer and gender role socialization are theories suited to intact families, but adolescents who live in a mother-only household often lack a male role model, which might have consequences for the field of study they enter. Due to the rising divorce rate, increasing numbers of children reside in a one-parent household and most of these children live with their mother (Spruijt & Kormos, 2014). Father's absence negatively effects educational attainment and, although less conclusive, test scores and educational engagement and aspirations (De Lange et al., 2014; Dronkers, 1994; McLanahan & Percheski, 2008; McLanahan et al., 2013). Only a few studies have examined the consequences of household type for field of study choices (Brolin Låftman, 2008; Murray & Sandqvist, 1990). Our study expands on previous research by studying how parents' occupational field leads to different fields of study depending on whether the adolescent lives in a mother-only household or in a two-parent household.

We use longitudinal data that we collected from adolescents and their parents in the Netherlands in 2010/2011 and 2011/2012, when the adolescents were 15 and 16 years of age. The adolescents were surveyed again in 2014 and 2015 after completing secondary education at the age of 18 and 19, respectively.

3.2 Theory

Direct transfer

Adolescents are more likely to choose a field of study that resembles their parents' occupational field owing to the intergenerational transmission of occupation-specific skills, cultural capital (like occupation-specific aspirations and beliefs), social networks and economic resources (Jonsson et al., 2009; Van de Werfhorst et al., 2001, 2000; Van de Werfhorst & Luijkx, 2010). For example, the children of a carpenter "…*may be especially likely to become carpenters because they are exposed to carpentry skills at home, socialized in ways that render them especially appreciative of carpentry as a vocation, and embedded in social networks that provide them with information about how to become carpenters and how to secure jobs in carpentry"* (Jonsson et al., 2009: 983). Parents transfer these occupational resources to their children, who actively draw upon these resources. This increases the likelihood that children choose a similar field of study as their parents' occupational field (e.g., more likely to choose carpentry than medicine). The intergenerational transfer of these occupation-specific resources happens regardless of how gendered this occupation is. This implies that direct transfer theory leads to gendered fields of study only insofar as mother or father is employed in a gender stereotypical occupation. In other words, boys or girls only enroll in a more masculine or feminine field of study if their parents are employed in a more masculine or feminine occupation. The theory of direct transfer does not lead to a specific expectation regarding which resources (mother's or father's) are more important. Unless both parents have the same occupation, an adolescent can only enroll in one field of study similar to one parent. The underlying premise is that one adolescent uses mother's occupational resources and might enroll in a similar field of study as mother's occupational field whereas another uses father's occupational resources and might enroll in a similar field of study as father's occupational field. Averaged over the whole population, the masculinity (or femininity) of adolescent's field of study will therefore be somewhere in between that of their parents. Based on the theory of direct transfer, we therefore hypothesize that *mothers who are employed in a more feminine*

(masculine) occupation will lead boys and girls to a more feminine (masculine) field of study (H1a), and *fathers who are employed in a more feminine (masculine) occupation will lead boys and girls to a more feminine (masculine) field of study (H1b).*

Dominance effects

From a rational choice perspective, it is likely that direct transfer depends on which parent has the highest status (who is more dominant; Hetherington, 1965; Korupp et al., 2002). If we assume that adolescents aspire to a social class as good as, or better than, that of their family, boys and girls will be likely to use the occupational resources of the occupational field of the parent with the highest status. The higher status parent could be either the mother or the father, because although men are employed in high-status occupations (such as managers) more often than women, they are also employed in low-status occupations (e.g. factory workers) more often than women. Women are more often employed in occupations between these two extremes (secretaries, nurses, teachers). If the dominant mother or father has a gender stereotypical occupation, and adolescents enroll in a similar field, it will result in a more feminine or masculine field of study, respectively. This also implies that if the dominant parent is of the opposite sex and has a gender stereotypical occupation, boys and girls will enroll in less gender stereotypical educational fields. In sum, if adolescents enroll in the occupation of the more dominant parent, we expect that *a more dominant parent who is employed in a more feminine (masculine) occupation will lead both boys and girls to a more feminine (masculine) field of study, whereas a less dominant parent who is occupied in a more feminine (masculine) occupation will have a weaker effect on the femininity (masculinity) of boys' and girls' field of study (H2).*

Research has shown that adolescents from a higher social class are more likely to choose a more prestigious field of study (e.g., science, technology, engineering, and mathematics; Van de Werfhorst, 2017; medicine and law: Van de Werfhorst et al., 2003), but we know of only one study that has evaluated the consequences of parental dominance for adolescent's field of study. Dryler (1998; Sweden) studied track choices of 16-year-old students in upper secondary education and found support for the theory of direct transfer, but only weak support for dominance.

Gender role socialization

Gender role socialization implies that children learn gender-specific norms, values and aspirations from their social environment. From early childhood onward, children develop beliefs and expectations that are associated with each sex group, known as gender roles or sex roles. The family is one of the most important sources of gender role socialization (Glass, Bengtson, & Dunham, 1986; Hitlin, 2006). Parents socialize their children by conveying ideas about what is "appropriate" behavior for their sex category, either because their behavior functions as an example of what is gender stereotypical male or female behavior (cognitive development theory; Kohlberg, 1966) or because they actively encourage behavior that complies with these gender expectations (social learning theory; Bandura, 1977).

Mothers and fathers can function as "appropriate" gender role models if their occupational field is "appropriate" for their sex category. Adolescents then learn traditional gender roles by observing their parents. Consequently, if adolescents conform to these gender roles, mothers and fathers in more gender stereotypical occupational fields will lead boys and girls to more gender stereotypical fields of study. Note that this gives rise to expectations that differ to some extent

from those based on direct transfer theory. If a mother has a gender stereotypical (female-dominated) occupation (e.g. nurse), this will lead a girl to a more feminine field of study in both explanations. For boys, however, gender role socialization theory predicts that having a mother in a more gender stereotypical occupational field will lead them to a more masculine field of study, whereas direct transfer theory predicts that they will enroll in a more feminine field of study. Similarly, if a father has a gender stereotypical (male-dominated) occupation (e.g. plumber), then both explanations will lead boys to more masculine fields of study. For girls, however, gender role socialization theory predicts that having a father in a more gender stereotypical occupational field will lead them to a more feminine field of study, whereas direct transfer theory predicts that they will enroll in a more masculine field of study. In sum, based on gender role socialization we expect that *mothers who are employed in more feminine occupational fields will lead boys to more masculine fields of study and girls to more feminine fields of study (H3a*). We expect that *fathers who are employed in more masculine occupational fields will lead boys to more masculine fields of study and girls to more feminine fields of study (H3b).* Figure 3.1 illustrates our expectations concerning the effects of parents' occupational field based on direct transfer and gender role socialization theory.

Previous research shows mixed results with respect to gender role socialization theory. Dryler (1998) found no support for gender role socialization. Polavieja and Platt (2014), who studied the effect of parents' occupational field on children's occupational aspirations, found strong support for gender role socialization. Both Støren and Arnesen (2007) and Leppel, Williams, and Waldauer (2001) found mixed evidence of both the theory of gender role socialization and direct transfer. However, two results stand out that support gender role socialization theory. Støren and Arnesen (2007: Norway) used retrospective data to examine choices in upper secondary education and found that boys enter more gender stereotypical fields when their mother has a gender stereotypical occupation (i.e., health, social care, child care and teaching). Leppel, Williams, and Waldauer's (2001: post-secondary students, U.S.) results suggest that mothers in non-traditional occupational fields influence boys to enter non-traditional fields as well.

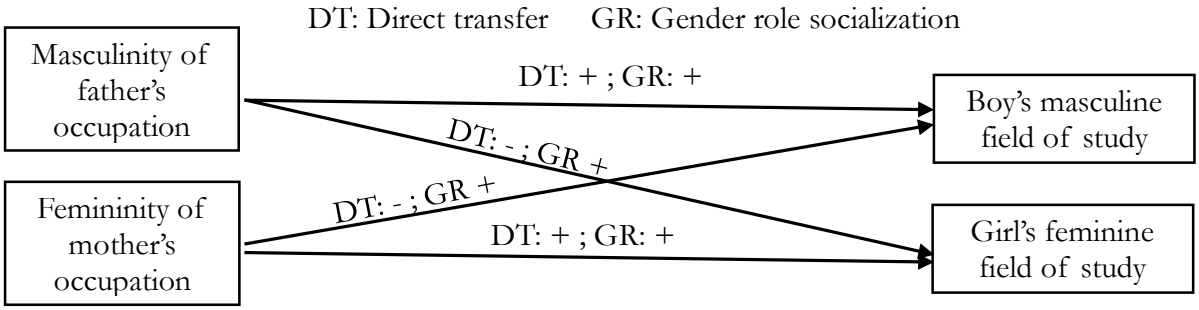

Figure 3.1 Expectations of the effect of parents' occupational field on boys' masculine field of study and girls' feminine field of study derived from the theory of direct transfer and gender role socialization.

Same-sex effects

Gender socialization theories suggest that adolescents specifically copy the parent of the same sex (same-sex influence) either because children are encouraged to do so (social learning theory) or because adolescents actively choose to copy the parent of the same sex (cognitive development theory). Girls are thus expected to be more likely to learn gender role behavior from their mother

and boys from their father. If parents' occupational fields function as an example of what is "appropriate" gender role behavior, then girls will choose a more feminine field of study if their mother has a more feminine occupational field. Similarly, boys will choose a more masculine field of study if their father has a more masculine occupational field. In sum, if boys and girls copy the parent of the same sex, we expect that *mothers who are employed in a more feminine occupational field will lead their daughter to a more feminine field of study, whereas fathers will not (H4a), and fathers who are employed in a more masculine occupational field will lead their sons to a more masculine field of study, whereas mothers will not (H4b).*

Research that focuses on gender differences in horizontal education found same-sex influence only for boys (Dryler, 1998; Støren & Arnesen, 2007) or found that opposite-sex influence is more important (Leppel et al., 2001). Leppel, Williams, and Waldauer (2001) found that having a father in a gender stereotypical occupational field (professional or executive occupation) had a larger effect on girls than having a mother working in the same masculine field, whereas the opposite holds for boys.

Household type

The theories of gender role socialization and direct transfer can both be applied to adolescents who live with two parents, but they might lead to different hypotheses for adolescents who live with only one parent. Because adolescents who live with only one parent in the Netherlands most often live with their mother, this study takes a first step towards identifying the consequences of household types for fields of study by formulating expectations for mother-only households compared to two-parent households.

In mother-only households, father's absence could mean less exposure to "male-typical" role models (Brolin Låftman, 2008). Direct transfer would then imply that, whereas adolescents from a two-parent household can draw upon the resources of either their mother *or* their father, adolescents in a mother-only household can only use mother's. Furthermore, the mother's occupation is automatically also the highest status occupation in mother-only households. Thus, on average, the femininity of the mother's occupation will lead adolescents in mother-only households to a more feminine field of study than mothers in two-parent households. In sum, direct transfer leads to the expectation that *mothers who are employed in a more feminine occupational field will lead boys and girls to a more feminine field of study, and this is more likely to occur if the adolescents reside in a mother-only household than if they live in a two-parent household* (*H5*).

According to gender role socialization theory, adolescents are exposed to "appropriate" gender role behavior if their mother is employed in a more feminine or their father in a more masculine occupation. If girls are more likely to learn gender role behavior from their mother, the effect of mother's occupational field should be no different for girls living in a mother-only household than for girls living in a two-parent household. We do expect to see a difference in the case of boys, however. Although gender role socialization theory states that children copy the parent of the same sex, without the presence of a father it seems plausible that the mother's occupational field will have a greater influence on boys in a mother-only household than on boys in a two-parent household. We therefore expect that *mothers who are employed in a more feminine occupational field will lead boys in a mother-only household to a more masculine field of study, compared to boys who live in a two-parent household (H6).*

3.3 Method

Dutch educational system and field of study

In the Netherlands, secondary education begins at the age of 12 and is compulsory until obtaining the "starting qualification" at the upper secondary level (age 17 of 18). After primary education (age 12), students can enter one out of three possible levels of secondary education depending on grades and test results. The majority enters VMBO, or the vocational level. This is a four-year vocational program after which pupils continue in secondary vocational education (MBO). The two other levels both provide access to higher education. The HAVO, or the general level, is a five-year program preparing students for universities of applied science that offers professional Bachelor degrees. VWO, or academic level, is a six-year program which prepares pupils for a research university that offers academic Bachelor degrees.

Students in the vocational, general or academic level enter a field of study at different time points. In order to finish compulsory education and get the "starting qualification", students who completed the vocational level are required to continue in secondary vocational education (MBO) for at least two years. These students enter a field of study when entering secondary vocational education (age 16). Students who finished the general level (age 17) and the academic level (age 18) have completed compulsory education and only students who continue their education choose a field of study.

Data

We use wave 1 (2010/2011) and wave 2 (2011/2012) of data collected in the Netherlands as part of the Children of Immigrants Longitudinal Survey in Four European Countries (CILS4EU) to measure our independent variables. The general focus of the CILS4EU is to explore the structural, cultural, and social integration of immigrant and non-immigrant children in four European countries (Kalter et al., 2014, 2015, 2016a, 2016b). These two waves were collected when the students were in their third year of secondary education (wave 1; age 14 - 15) and when they were in their fourth year of secondary education (wave 2; age 15 - 16).

We included respondents who participated in wave 1 as well as newcomers who filled in a newcomer questionnaire in wave 2.[1] Our independent variables are thus measured in either the first *or* second wave. Since our independent variables (e.g., household type, parents' occupation) are relatively stable over time, and both wave 1 and wave 2 were conducted before the students chose their field of study, we use both waves to increase sample size.

We additionally use wave 4 (2014) and 5 (2015), which are part of the continuation of this project in the Netherlands: Children of Immigrants Longitudinal Survey in the Netherlands (CILSNL; Jaspers & van Tubergen, 2014, 2015). Because the age at which students enter field of

[1] In the second wave, additional students and parents who were not part of the sampling frame entered the survey because (some) students changed class from wave 1 to wave 2 and whole classes were asked to participate in wave 2 (n = 2127). Wave 2 did not contain all the information needed, but we included two groups of students. First, these students were given a newcomer questionnaire that resembled the questionnaire from wave 1. In total, 805 respondents filled this in and 478 are in our analyses (because these participated in wave 4 or 5). Second, we included respondents who participated only in wave 2 when their parents also participated in either wave 1 or wave 2 (n = 118).

study is different depending on the secondary educational level they follow, using wave 4 (age 18) and wave 5 (age 19) allows us to measure field of study for students of all levels of secondary education. Field of study is thus measured in either wave 4 *or* wave 5.[2]

The sample was selected based on a sample design stratified according to educational level and percentage of non-western immigrants in a school. This means that schools were selected with probability proportional to their size using the number of pupils at the relevant educational level. Additionally, schools with non-western immigrant children were oversampled. In order to correct for possible selection bias and to enhance the validity of our results, we weight our analytical sample based on national statistics from Statistics Netherlands (CBS) using the numbers of pupils with a western and non-western background in the third and fourth year of secondary education in the vocational, general or academic level in the Netherlands in 2010/2011 (Statistics Netherlands, 2010, 2011). The initial response rate of schools was 34.9%. To increase the school response rate a replacement strategy was used in which non-responding schools were replaced with other similar other (response rate after replacement: 91.7%).

In wave 1 and 2, respondents filled in a self-completion questionnaire in their class at school (student participation rate = 91.1%). Additionally, adolescents were given a questionnaire for one of their parents to fill in at home. To increase parents' participation rate parents received an abbreviated questionnaire in the third reminder and were contacted by phone if necessary to ask them to participate by completing the shorter version (parents' participation rate: wave 1: 74.7%; wave 2: 42.8%). The response rate of wave 4 is 55.5% and wave 5 is 54.4%, both calculated as the ratio between the number of respondents who participated and the number of adolescents who had been approached and did not refused participation before the start of wave 4 or 5, respectively. In both waves a mixed mode approach was used. In wave 4, approximately 69% completed an electronic questionnaire, 10% filled in a print questionnaire, and 21% responded by telephone. In wave 5, approximately 85% completed an electronic questionnaire, 1% filled in a print questionnaire and 14% responded by telephone.

In total, 4963 respondents participated in wave 1 and we included extra 596 students who participated in wave 2. Of these respondents, we included adolescents who chose a field of study after secondary education (wave 4: 1853; wave 5: 959) and whose household type is known (n = 2497 two-parent households; n = 315 mother-only households). In total, 2812 respondents and 2395 parents (n = 373 short questionnaires; n = 2022 long questionnaires) are included in our analyses.

Measures

Dependent variable

Gender stereotypical field of study signifies masculinity in boys' field of study and femininity in girls' field of study. Students were asked to describe their current studies. The answers were coded into fields of study based on the 3-digit International Standard Classification of Education Scale (ISCED97; UNESCO, 2006). We used separate classification schemes for secondary vocational education (MBO) and higher vocational education (HBO) & university from Statistics Netherlands.

[2] Students from the vocational level entered a field of study in wave 3. However, because field of study was not asked in wave 3, we use information on their field of study from wave 4.

Both schemes contain the 3-digit ISCED-field codes for all fields of studies. To indicate how gender stereotypical fields of study are, we obtained from Statistics Netherlands the percentage of female or male students enrolled in the relevant field of study in the Netherlands in either secondary vocational education or higher vocational education & university in 2013/2014 or 2014/2015, depending on the level of education of the field of study or in which year they choose their field of study (Statistics Netherlands 2013, 2014, 2015).[3] Table B.1 in appendix B shows this coding. A higher score thus indicates a more gender stereotypical field of study for both boys and girls. In our data, the secondary vocational education field with the highest percentage of female students is hair and beauty services (97.55%) and the field with the lowest percentage of female students is electricity and energy (0.64%). For higher vocational education and university, the field with the highest percentage of female students is educational science (92.04%) and the field with the lowest percentage of female students is electronics and automation (3.85%).

Independent variables

Femininity of mother's occupation and masculinity of father's occupation are two variables that reflect how gender stereotypical their occupational field is. 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). The occupations were coded according to the International Standard Classification of Occupations 2008 (ISCO08). Missing values were replaced with information provided by the adolescents, who also answered questions about their parents' main occupation. However, adolescents 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 (n = 792).[4] In our analyses, we include two control variables called occupation mother reported by student and occupation father reported by student, indicating when the parent's occupation did (1) or did not (0) originate from the student questionnaire.

To indicate the masculinity/femininity of a job, we calculated the percentage of women working in that job in the Netherlands using pooled data from the European Labour Force data (EU-LFS). The EU-LFS is a large household sample survey carried out by national statistics institutes (in the Netherlands: Statistics Netherlands) providing quarterly results on labor participation of people aged 15 and over. We obtained the annual average of quarterly data covering 2011 to 2015.[5] This file contains weighted data on employed persons in the Netherlands between 2011 and 2015. The occupation of the persons in the data were coded according to the 3-digit ISCO08 coding and we pooled these years in order to have as many observations as possible within one occupational category. This resulted in a dataset containing 40,850,663 observations. On average, there were 281,729 observations per ISCO08 occupation. In our analyses, "Production managers in agriculture, forestry and fisheries" is the field with the least amount of people (n = 518) and "Shop salespersons" the most (n = 2,306,301). In percentages, "Building finishers and

[3] The numbers from secondary vocational education are not available online. We requested them from Statistics Netherlands. They are available upon request from the authors.

[4] This number is quite high because parents who filled in the short questionnaire did not answer questions about partner's occupation.

[5] We use the data from 2011 onwards because this is the year that the LFS-EU went from the ISCO88 to the ISCO08 coding.

related trades workers" have the fewest women (0.87%) and "Secretaries (general)" the most (98.01%). We excluded fathers (n = 5) and mothers (n = 33) in our analyses who indicated that they have never worked.

To calculate *father's dominance*, we recoded ISCO08 codes into the standard International Socio-Economic Index of occupational status scores (ISEI) using conversion tools (Ganzeboom & Treiman, 2014). Subsequently, we divided father's ISEI score by the sum of mother's and father's ISEI scores and subtracted 0.5. Father's dominance then ranges from -0.4 to 0.4, with positive values meaning that the father is more dominant, negative values meaning that the mother is more dominant, and 0 meaning mother and father are equally dominant.

Mother-only household indicates that the child lives with only the biological or adoptive mother (1). The reference category is a two-parent opposite-sex household (two biological or adoptive parents (n = 2288), biological mother and stepfather (n = 187) or biological father and stepmother (n = 22)).[6] Parents were asked to indicate how they were related to the child (e.g., biological or adoptive mother/father, stepfather). Moreover, they were asked whether they have a (marriage) partner, live with this partner and whether this partner is the child's biological parent. Adolescents were asked whether they live with both biological parents in one house (yes/no). Additionally, adolescents indicated with whom they live (biological mother, biological father, stepmother etc.), whether they regularly (at least once a week or once every two weeks) live in another/second home, and who lives in this second home (biological mother, biological father, stepmother etc.). We constructed the variable mother-only household based on information provided by parents and adolescents combined. We relied on the adolescent's answers if the parents did not fill in the questionnaire. Moreover, as we do not know how adolescents divide their time between their first and second home, we took the family composition of the first home as their main residence. Because only a small number of children reside with only a male guardian, we excluded this group (n = 39).

Controls

Highest educational level parents. We controlled for parents' highest educational level because a higher educational level can lead to less gender stereotypical fields of study for both boys and girls (Dryler, 1998; Støren & Arnesen, 2007). Parents were asked what their and their partner's highest level of education was. This resulted in a scale indicating whether mother or father had no education (0), primary education (1), secondary education (2), vocational education and training (3), higher vocational education (4) or university (5). We replaced missing values with information provided by the adolescents, who indicated whether their mother (father) had completed primary education, secondary education or university. We only replaced parents' missing values if respondents indicated that they live with their biological parents (n = 504).

[6] Of all the two-parent families surveyed (n = 2497), 92% of the adolescents (n = 2228) live with both biological parents. Running the analyses again while excluding stepfamilies showed similar results, which are available upon request. Moreover, the effect of parents' occupational field in stepfamilies did not differ from the same effect on adolescents living with both biological parents.

We controlled for *non-western immigrant background*. This variable indicates whether one of adolescents' parents, were (1) or were not (0) born outside western countries.[7]

Vocational level, general level and *academic level* are three dummies that indicate whether an adolescent in secondary education is in the vocational level (1) or not (0), in the general level (1) or not (0), or in the academic level (1) or not (0). In our analyses, the vocational level will be the reference category. These variables are included to capture differences in what fields of study adolescents enter between levels of secondary education. Table 3.1 shows the descriptive statistics of all variables.

3.4 Analyses

To examine gender differences in fields of study, we use multiple-group structural equation modelling in STATA. Since our data are hierarchically structured (students are nested in classes), standard errors were adjusted by clustering on class level at T1 ($N_{classes}$ = 247) to take into account the non-independence of our data.[8] In all analyses, we compared boys and girls. The advantage of multiple group analyses is that the first allows us to use full information maximum likelihood estimation (FIML) to account for missing data at random. This method uses all observed variables in the model to estimate the means and covariances of item nonresponse. This method outperforms listwise deletion (which ordinary linear regression uses) and other substitution methods (Enders & Bandalos, 2001; Graham, 2009). FIML relies on data missing at random (MAR) and research has found that this method resulted in unbiased parameter estimates, even in some cases that violated this assumption (e.g. Enders, 2010; Enders & Bandalos, 2001; Graham, 2009; Larsen, 2011).

Table 3.2 shows the results that allow us to evaluate hypotheses 1 to 4 concerning the theory of direct transfer and gender role socialization. These analyses include two-parent households. We start with the simplest model in which parents' characteristics are constrained to be equal across groups (model 1). Subsequently, we freely estimate effects of mother's and father's occupational field on boy's and girl's field of study to see whether parents affect their son our daughter differently (model 2). Lastly, we add interaction effects to test our hypothesis concerning parental dominance (model 3). In models 1 and 2, we constrain the effect of the variable father's dominance and the interaction effects to 0 to ensure that model 1 is nested in models 2 and 3.

Table 3.3 shows models that test (gender) differences between two-parent households and mother-only households. Model 1 contains two-parent households and includes mother's and father's characteristics. This model is similar to model 1 in table 3.2, the only difference being that father's dominance and the interactions are excluded. Models 2 and 4 contain two-parent

[7] 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.

[8] All respondents who only participated in wave 2 and who were still in our sample were given a separate class identifier (n = 596).

households and only mother's characteristics. Model 4 differs from model 2 by allowing the effect of mother's occupation to be different for boys and girls. Models 3 and 5 contain only adolescents who live in a mother-only household. Model 5 allows for differences between boys and girls. We use Wald-tests to test whether effects differ between models. In all models estimated, we constrained control variables to be equal for boys and girls as freeing parameters did not significantly improve our models.

To show how mother's and father's occupational field might be more relevant for some groups than for others, we ran all models in table 3.2 again per level of secondary education, educational background and non-western immigrant status. Results are in appendix B.

Table 3.1 *Descriptive statistics of variables for all respondents (N = 2812) and boys (n = 1167) and girls (n = 1645) separately.*

	Mean (SD)			*Min*	*Max*	*n*
	Total	Boys	Girls	Total	Total	Total
Dependent variable						
Gender stereotypical field of study	66.73 (23.16)	66.08 (23.09)	67.65 (23.25)	0.90	99.36	2812
Independent variables						
Femininity of mother's occupation	67.35 (20.02)	67.51 (21.87)	67.24 (22.13)	0.87	98.01	2624
Masculinity of father's occupation	68.60 (24.93)	67.31 (25.22)	69.56 (24.67)	1.99	99.13	2286
Father's dominance	0.02 (0.13)	0.02 (0.13)	0.02 (0.13)	-0.37	0.36	2207
Mother-only household	.11	.10	.12	0	1	2812
Controls						
Occupation mother reported by student	.19	.19	.19	0	1	2812
Occupation father reported by student	.17	.18	.17	0	1	2812
Highest educational level parents	3.16 (1.11)	3.23 (1.10)	3.11 (1.11)	0	5	2799
Non-western immigrant background	.18	.16	.19	0	1	2812
Vocational level	.53	.54	.52	0	1	2812
General level	.29	.28	.29	0	1	2812
Academic level	.19	.19	.18	0	1	2812

Source: Wave 1 and wave 2 of Children of Immigrants Longitudinal Survey in four European Countries and wave 4 and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations.
Note: For categorical variables, proportions are given.

3.5 Results

Model 1 in table 3.2 tests our hypotheses concerning gender role socialization. In line with hypothesis H3a, this model shows that mothers with a more feminine occupation lead to adolescents choosing a more gender stereotypical field of study. Her effect is relatively small. A 10 percent increase in the share of women in mother's occupational field is associated with a .7 percent increase in the share of own-gender students in adolescent's field of study. Father's masculine occupational field (H3b) does not affect which field of study adolescents enter.

Model 2 tests whether the femininity of mother's occupational field and the masculinity of father's occupational field have a different effect on boys and girls. The effect of mother's occupational field is significant for girls, but not for boys. However, the effect of mother's occupational field is not different for boys and girls (Wald z-score = 0.39, $p = 0.53$). This supports the theory of gender role socialization with respect to the influence of mothers (H3a): mothers influence boys to choose more masculine fields of study and girls to choose more feminine fields of study. The masculinity of father's occupational field has no influence on boy's or girl's field of study, refuting our hypotheses concerning direct transfer effect (H1b) and (again) gender role socialization (H3b).

Although model 2 and 3 show support for a mother-daughter same-sex effect (H4a), we already concluded that the effect of mother's feminine occupation on daughter's field of study is not significantly different from the effect of mother's occupation on son's field of study. Additionally, no father-son same-sex effect was found (H4b). Therefore, our data do not support the hypotheses concerning same-sex influence (H4a & H4b).

Model 3 includes an interaction between the femininity of mother's occupation as well as the masculinity of father's occupation and the variable father's dominance for boys and girls separately. This model tests whether a more dominant parent employed in a more feminine (masculine) occupation results in boys and girls choosing a more feminine (masculine) field of study (H2). We find that when fathers have a more dominant occupation, girls are more likely to choose a more masculine field of study. However, the interaction terms are not significant, meaning our data do not show any dominance effects (H2).

All models in table 3.2 reveal that a higher-educated parent leads boys and girls to less gender stereotypical fields of study. Moreover, adolescents in the general and academic level enter less gender stereotypical fields of study than those in the vocational level. Lastly, students with a non-western immigrant background enter less gender stereotypical fields of study than students with a western background.

Horizontal and vertical characteristics

Table 3.2 shows that the femininity of mother's occupational field leads to gender differences in fields of study. However, horizontal characteristics are often intertwined with vertical characteristics (characteristics that focus more on differences in level; Jonsson et al., 2009). An example of how horizontal and vertical characteristics might relate is that if an adolescent enters a field of study similar to that of his/her mother's or father's occupational field, that educational field is likely to lead to a similar occupational field and thus also to a similar occupational status. Intergenerational transmission of occupational field is then automatically also intergenerational transmission of status. We therefore checked how mother's and father's vertical and horizontal characteristics relate to which field of study boys and girls enter.

We ran all analyses in table 3.2 again including mothers' and fathers' occupational status or the highest occupational status within a couple *in addition to* or *instead of* mother's and father's occupational field. We conclude that the effect of mother's occupational field remained significant and more important than parents' vertical characteristics. None of the occupational status variables have a significant effect on adolescent's field of study. Only when controls were excluded, mother's, father's or highest occupational status lead adolescents to less gender stereotypical fields of study

Table 3.2 *Unstandardized coefficients and standard errors of multiple-group analyses of predictors of masculine field of study choice for boys and feminine field of study choice for girls who live in two-parents households (n = 2497).*

	Model 1		Model 2		Model 3	
	Boys	Girls	Boys	Girls	Boys	Girls
	B		*B*	*B*	*B*	*B*
	(SE)		*(SE)*	*(SE)*	*(SE)*	*(SE)*
Independent variables						
Femininity of mother's occupation	0.07**		0.05	0.08**	0.04	0.08**
	(0.02)		(0.04)	(0.03)	(0.04)	(0.03)
Masculinity of father's occupation	-0.01		0.04	-0.04	0.05	-0.04
	(0.02)		(0.03)	(0.02)	(0.03)	(0.02)
Father's dominance					9.68	40.29*
					(28.35)	(19.93)
Femininity of mother's occupation					0.25	-0.25
× Father's dominance					(0.29)	(0.24)
Masculinity of father's occupation					-0.33	-0.41
× Father's dominance					(0.23)	(0.24)
Controls						
Occupation mother reported	-0.50		-0.52		-0.41	
by student	(1.26)		(1.26)		(1.26)	
Occupation father reported	-0.24		-0.11		-0.08	
by student	(1.26)		(1.24)		(1.26)	
Highest educational level parents	-1.09**		-1.11**		-1.07**	
	(0.39)		(0.39)		(0.39)	
Non-western immigrant	-4.56**		-4.64***		-4.62***	
background	(1.40)		(1.41)		(1.38)	
General level	-5.02***		-4.93***		-4.86***	
	(1.05)		(1.03)		(1.02)	
Academic level	-6.52***		-6.49***		-6.48***	
	(1.62)		(1.63)		(1.66)	
Constant	71.07***	69.30***	69.20***	70.92***	68.95***	70.08***
	(2.48)	(2.53)	(3.25)	(2.79)	(3.28)	(2.84)

Source: Wave 1 and wave 2 of Children of Immigrants Longitudinal Survey in four European Countries and wave 4 and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

for both boys and girls. The status variables, however, lose their significance when parents' highest education is included and/or when we control for differences in field of study choices between levels of secondary education. This means that horizontal characteristics and vertical characteristics are intertwined, in which education plays a key role in at least two ways. First, parents who are employed in a higher status occupation are more likely to have a higher education ($r = 0.52$, $p < .001$) and, as we see in table 3.2, adolescents who have parents with a higher educational background are less likely to enter gender stereotypical fields of study. Second, adolescents with

parents who are employed in a higher status occupation are more likely to end up in higher levels of secondary education ($F(2, 2457) = 107.78$, $p < 0.001$), which also leads boys and girls to less gender stereotypical fields of study. Nevertheless, irrespective of occupational status, the effect of mother's occupational field is robust and affects which field of study adolescents enter.

To further explore how horizontal characteristics are intertwined with vertical characteristics all analyses in table 3.2 were run again separately per level of secondary education and for adolescents with a higher-educated background and adolescents with an average/lower-educated background. Due to the fact that the original CILS4EU sample contained an oversampling of non-western immigrant background, we also ran all analyses again for western and non-western students. Results are in in appendix B.

From appendix B we conclude that the femininity of mother's occupational field is important for adolescents in the general level, for adolescents from lower/average-educated families, and for adolescents from non-western immigrant backgrounds. Mothers who are occupied in a more feminine occupation lead both boys and girls to more gender stereotypical fields of study. Father's occupational field seems more important for adolescents who are enrolled in higher levels of secondary education and for adolescents from higher-educated families. For adolescents in the general level, father's masculine occupational field leads boys and girls to *less* gender stereotypical fields of study, whereas his masculine occupational field leads boys to *more* gender stereotypical fields of study in the academic level and for boys from higher-educated backgrounds. Fathers lead girls from higher-educated backgrounds to *less* gender stereotypical fields of study.

Household type

Table 3.3 allows us to evaluate gender differences in the effect of mother's occupational field on adolescents who live in mother-only households compared to adolescents who live in two-parent households. Model 1 shows again that mother's feminine occupational field leads boys and girls to choose more gender stereotypical fields of study in two-parent households. The effect is similar when we do not control for father characteristics (model 2). Model 3 shows the results when we include only respondents from mother-only households. The effect of mother's occupational field does not reach significance. This could be due to the low number of adolescents in our data who live with only their mother, as the effect of mother's feminine occupational field is the same, whether adolescents live in two-parent or mother-only households (Wald z-score = 0.25, $p = 0.80$). We thus find no support for hypothesis 5, which states that the effect of mother's feminine occupation will lead to adolescents in mother-only households choosing a more feminine occupation than adolescents in two-parent households.

Models 4 (two-parent households) and 5 (mother-only households) are similar to models 2 and 3, but in models 4 and 5 the effect of mother's feminine occupation is estimated separately for boys and girls. The data do not support hypothesis 6. Mother's feminine occupation is not more likely to lead to boys in a mother-only household choosing a more masculine field of study than boys in a two-parent household (Wald z-score = 1.15, $p = 0.25$). Moreover, model 5 shows no significant effect of mother's occupational field for boys and girls and mother's occupational field does not affect boys and girls differently (Wald z-score = 2.65, $p = 0.10$).

Table 3.3 *Unstandardized coefficients and standard errors of multiple-group analyses of predictors of masculine field of study choice for boys and feminine field of study choice for girls who live in two-parents households (n = 2497; model 1,2 & 4) and for adolescents who live in mother-only households (n = 315; model 3 & 5).*

	Model 1		Model 2		Model 3		Model 4		Model 5	
	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys	Girls
	B		*B*		*B*		*B*		*B*	
	(SE)		*(SE)*		*(SE)*		*(SE)*		*(SE)*	
Independent variables										
Femininity of mother's occupation	0.07**		0.07**		0.05		0.05	0.08**	-0.07	0.11
	(0.02)		(0.02)		(0.06)		(0.04)	(0.03)	(0.10)	(0.08)
Masculinity of father's occupation	-0.01									
	(0.02)									
Controls										
Occupation mother reported by student	-0.50		-0.57		0.690		-0.57		0.98	
	(1.26)		(1.17)		(2.73)		(1.17)		(2.71)	
Occupation father reported by student	-0.24									
	(1.26)									
Highest educational level parents	-1.09**		-1.05**		-1.16		-1.06**		-1.09	
	(0.39)		(0.37)		(1.42)		(0.37)		(1.43)	
Non-western immigrant background	-4.57**		-4.57***		-0.02		-4.56***		-0.05	
	(1.40)		(1.37)		(2.57)		(1.38)		(2.59)	
General level	-5.02***		-5.00***		-4.24		-5.00***		-3.85	
	(1.40)		(1.04)		(2.78)		(1.04)		(2.84)	
Academic level	-6.52***		-6.51***		-7.55**		-6.49***		-7.32**	
	(1.62)		(1.62)		(2.81)		(1.63)		(2.81)	
Constant	71.09***	69.39***	70.52***	68.74***	66.35***	67.55***	71.61***	68.04***	73.87***	62.48***
	(2.48)	(2.53)	(2.08)	(2.03)	(7.45)	(7.71)	(2.60)	(2.35)	(8.82)	(8.61)

Source: Wave 1 and wave 2 of Children of Immigrants Longitudinal Survey in four European Countries and wave 4 and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

3.6 Conclusion and discussion

In this chapter we examined the effect of parents' occupational field on adolescent's field of study and contrasted two explanations. On the one hand, the theory of direct transfer states that parents transfer occupation-specific resources to their children, who actively draw upon these resources. Direct transfer happens irrespective of the parent's sex, but adolescents are more likely to draw upon the resources provided by the more dominant (higher status) parent. On the other hand, gender role socialization theory implies that boys and girls learn "appropriate" gender role behavior from their parents and that boys are more likely to learn this from their father and girls from their mother. This chapter additionally evaluated how these theories differ for adolescents who reside with only their mother, compared to adolescents who live in a two-parent household. We used multiple-group analyses on longitudinal data collected from adolescents and their parents in the Netherlands to test our hypotheses.

Our results largely support the theory of gender role socialization. We found that mother's feminine occupational field leads boys and girls to a more gender stereotypical field of study. In accordance with the theory of gender role socialization, this suggests that mother's behavior exemplifies "appropriate" behavior for one's sex category. Consequently, if mothers are employed in a more feminine occupation, boys will choose a more masculine field of study and girls a more feminine field of study. This is in line with previous studies that concluded that mothers in a non-traditional occupational field result in adolescents choosing non-traditional fields (Leppel et al., 2001; Polavieja & Platt, 2014; Støren & Arnesen, 2007). However, whereas these studies find this effect only for girls (Polavieja & Platt, 2014) or boys (Leppel et al., 2001; Støren & Arnesen, 2007), we conclude that mother's occupation affects both boys' and girls' field of study.

Contrary to the theory of gender role socialization, we find sparse evidence that it is more likely for boys to learn gender role behavior from their father and for girls to learn gender role behavior from their mother. Mother's occupational field has a similar influence on boys and girls, and father's occupational field has little effect on which field of study adolescents enter. Although the effect of mother's occupational fields is relatively small, it does imply that if more mothers were employed in more masculine occupations, more boys and girls would enter gender atypical fields. We can conclude that whereas previous research mainly focused on father's occupation (Van de Werfhorst et al., 2001; Van de Werfhorst & Luijkx, 2010), our results highlights that mother's occupation is important for the adolescent's field of study.

Our study shows that horizontal characteristics (parents' occupational field) are intertwined with vertical characteristics (level of secondary education and parents' highest education). Overall, mother's feminine occupational field leads to more gender stereotypical fields of study for boys and girls from lower/average-educated backgrounds, whereas father's masculine occupational field matters for adolescents in higher education and from higher-educated backgrounds. Whereas mothers seem to reinforce gender role behavior for both boys and girls, father's occupational field reinforces traditional gender role behavior for boys (sex role learning and direct transfer), but reduces traditional gender role behavior for girls (direct transfer). This seems to indicate that when the stakes are higher (for higher-educated parents and children) children are more likely to profit from the resources of their father. This may be the case because even among the higher-educated,

mothers are more likely to work part-time than fathers. When the stakes are lower (for children for lower/average-educated backgrounds), mothers socialize their children into "appropriate" gender roles. The overall effect of the mother is more visible, because fathers' effects are sometimes opposite, depending on gender of the child and educational level. These results are in line with other studies, showing that mechanisms that lead to gender segregation in fields of study can work differently for different levels of secondary education (Imdorf, Hegna, & Reisel, 2015) and/or for boys and girls from different social backgrounds (Van de Werfhorst, 2017; Van de Werfhorst et al., 2003). We encourage future research to further explore this intersectionality and study how parents' occupational field affect gender differences in fields of study for adolescents from different education levels and social backgrounds.

Although the theories of direct transfer and gender role socialization are suited to two-parent households, they might work differently for adolescents from mother-only households. We argued that adolescents who live with only their mother have less exposure to male-typical role models (Brolin Låftman, 2008), which means the effect of mother's feminine occupational field would be bigger in mother-only households compared to two-parent households (direct transfer) or that mother's feminine occupational field would have a bigger influence on boys in a mother-only household compared to boys in a two-parent household (gender role socialization). We found no evidence that mother's occupational field has a different influence in mother-only households. Although research has shown that household type can contribute to (gender) inequalities in educational attainment or achievement (De Lange et al., 2014; Dronkers, 1994; McLanahan & Percheski, 2008; McLanahan et al., 2013), we find no evidence that it leads to gender differences in fields of study. We took a first step to look at how household type might affect gender differences in fields of study and encourage future research to further explore this topic. For example, parents' influence might differ depending on the events that lead to a household type (e.g., divorce, death, migration, and incarceration) as well as differ by family constellation (e.g., stepfamilies, father-only household; Amato & Anthony, 2014; McLanahan & Percheski, 2008; McLanahan et al., 2013).

We found little support for direct transfer. This may be because we defined our dependent variable in terms of masculinity and femininity of a field of study. Direct transfer may well be important, but it could be that using parental resources does not translate in a similar masculine/feminine fields. For example, a surgeon (more masculine) might influence his son to go into a health-related educational program, which can be either masculine (bioinformatics) or feminine (nursing).

One interesting finding and topic for future research is that adolescents with a non-western immigrant background choose less masculine fields of study than their western peers. One possible explanation is that non-western ethnic minorities choose more lucrative fields (like business or economic-orientated fields) to compensate for their relatively lower socioeconomic status. Although these fields are not feminine per se, there are more women working in them than in math- or science-related fields, possibly making these fields of study less masculine by comparison. We also find that mother's occupational field is particularly important for adolescents with a non-western immigrant background. This could be because it might be (even) more unusual for women to work in non-western societies. So if they do work, they are a big influence on their sons and/or daughters. Mother's "non-traditional" behavior would then lead to more non-traditional (gender

atypical) educational fields. We encourage future research to explore how parents' influence might lead to gender differences in fields of study for adolescents from different immigrant backgrounds.

This study was conducted in the Netherlands, which is an interesting context for examining gender differences in fields of study because horizontal educational choices are made at various educational levels (secondary and tertiary level). However, in order to better understand how family characteristics affects which fields of study adolescents enter, this field could benefit from replicating our study in countries with a different educational system in which horizontal educational choices are made at a later time-point or at a specific educational level (e.g., choice of major in tertiary education in the United States) as well as in countries where gender segregation on the labor market is less pronounced (Bettio & Verashchagina, 2009). Moreover, many women, and mothers, in the Netherlands work part time. If women who work part time are more often employed in female-dominated occupations, the effect of mother's occupation may not really stem from her occupational field, but more from the general socialization effect that comes from spending time with her child. Unfortunately, we were not able to take into account parents' employment hours, but in order to disentangle this effect, future research should compare mothers with different (or no) employment hours. Similarly, given that part-time working jobs are often more feminine and full-time jobs more masculine (OECD, 2002), the effect of mother's occupational field could also be a result of the fact that daughters learned from their mother's feminine occupation that it is "appropriate" for women to work in feminine part-time fields, whereas boys learned that it is "appropriate" for men to work in more masculine full-time fields. In order to disentangle this effect, future research should compare the effect of mother's occupational field by comparing countries with differing levels of part-time employment.

Overall, this chapter highlights the role of horizontal characteristics when examining which field of study adolescents enter and concludes that we need to look beyond the role of the father and additionally include mothers in explanatory analyses. Moreover, whereas household type can lead to gender differences in educational attainment and achievement, we find no evidence that it leads to gender differences in fields of study.

Chapter 4

Sibling influence in field of study choices*

Abstract

This study evaluates sibling influence in field of study choices. On the one hand, the theory of direct transfer posits that sibling similarities in fields of study arise because older siblings transfer field-specific resources to their younger siblings. This is more likely to occur when siblings differ more in age or when the older sibling is higher educated. On the other hand, gender role socialization theory posits that gender differences in fields of study arise because younger siblings conform to "appropriate" male or female gender roles, which they learn from their older sibling's field of study. This is more likely to occur when siblings are of the same sex. We analyze 1607 sibling pairs using conditional logit models. In line with direct transfer theory, younger siblings tend to follow their older sibling's field of study, irrespective of parent's occupational field. These sibling similarities are not stronger when siblings differ more in age or when the older sibling is higher educated, nor do they depend on the sex composition of the sibling dyad or the specific field chosen by the older sibling. We conclude that the influence of older siblings does not lead to gender differences in fields of study. We find that not only the field of study of the older sibling closest in age is important, but also the field of study of subsequent older siblings. Our results imply that when interventions meant to increase the number of individuals entering certain fields of study target one child in the family, they may have indirect effects on that child's younger sibling, but do not decrease gender segregation in the field of study.

Key words: Sibling influence, Field of study, Gender role socialization, Direct transfer.

* This chapter was co-authored by dr. Jeroen Weesie. Van der Vleuten wrote the main part of the manuscript and conducted the analyses. Weesie contributed substantially to the analyses and results section of this manuscript. An earlier version of this chapter was presented at the Interuniversity Study Group Social Stratification and Life Course (Utrecht, The Netherlands, 2017).

4.1 Introduction

Choosing a field of study is an important decision for an individual's future career, and research shows that boys and girls enter different fields of study (Eccles, 2011). Girls remain underrepresented in gender stereotypical masculine fields like science, technology, engineering, and mathematics, whereas boys are underrepresented in gender stereotypical feminine fields like education and humanities (Mann & DiPrete, 2013; OECD, 2009; Xie et al., 2015). This unequal distribution of boys and girls across educational fields leads to gendered occupational careers and contributes to gender differentials in earnings (Blau & Kahn, 2016; Smyth & Steinmetz, 2008). It is therefore important to increase our understanding of the mechanisms that lead boys and girls to choose different fields of study. One factor shown to have a particularly strong influence on an individual's educational career is the family (Eccles, 2011). In this regard, research has focused on how parents influence their children's field of study (see also chapter 3 of this dissertation; Davies & Guppy, 1997; Dryler, 1998; Van de Werfhorst & Luijkx, 2010), but there has been much less research 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 chapter focuses on how older siblings affect their younger sibling's field of study after secondary education. 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 to be influenced by their siblings' field of study, their 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, 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 how siblings affect educational outcomes (school achievement: Adermon, 2013; educational attainment: Benin & Johnson, 1984; college choice: Goodman et al., 2016; high school graduation outcomes: Oettinger, 2000; years of schooling: Qureshi, 2011). For example, older siblings have a positive effect on years of schooling (Qureshi, 2011) or on educational achievement (Oettinger, 2000). However, much less is known about how siblings influence one another's field of study (Anelli & Peri, 2014; Chen, 2016; Joensen & Nielsen, 2015a).

We use two theories that lead to different hypotheses on how older siblings affect their younger sibling's field of study. This first theory is *direct transfer* and it entails that older siblings transfer field-specific resources (e.g., information, skills) to their younger siblings, who can draw upon these resources to make their field of study choice. Based on direct transfer theory, we argue that the transfer of field-specific resources is more likely to occur when siblings differ more in age or when the older sibling is higher educated. The second theory is *gender role socialization* theory and explains how older siblings might lead boys and girls to different fields of study. Gender role socialization theory posits that younger siblings learn what is "appropriate" male or female gender role behavior by watching their older sibling's behavior (Bandura, 1977; Kohlberg, 1966). An older

sibling's field of study might be an especially important reflection of what is "appropriate" male or female gender role behavior that could influence which field of study younger siblings enter. Gender role socialization theory states that that younger siblings are more likely to learn gender role behavior from their older same-sex sibling. The literature has focused less on siblings as gender role socialization agents than on parents or peers. However, siblings provide the unique opportunity to learn cross-gendered behavior in "peer-like" relationships, which might be especially important during adolescence, when the peer context is extremely gender-segregated (Mehta & Strough, 2009; Updegraff, McHale, & Crouter, 2000). By contrasting these two theories, we aim to increase our understanding of the mechanisms that underlie sibling influence in fields of study.

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 1607 sibling pairs 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 US, where students choose college majors; Legewie & DiPrete, 2014; Ost, 2010). 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 chapter is therefore able to focus on a wider group than only tertiary-level students. Additionally, these data allow us to shed light on the role of older siblings controlled for family characteristics (e.g., parents' occupational field; socio-economic status). Lastly, in the case of multiple siblings, we shed light on which older sibling might exercise more influence on a younger sibling's field of study and evaluate possible sequential or cumulative effects of older siblings.

4.2 Theory

Direct transfer theory

The theory of direct transfer posits that older siblings transfer field-specific resources, such as skills, social contacts, cultural capital (e.g., aspirations and beliefs) to their younger siblings. This line of reasoning is commonly used in social stratification literature to explain the intergenerational transmission of occupation-specific resources from parents to children (see chapter 3 of this dissertation; Jonsson, Grusky, Carlo, Pollak, & Brinton, 2009; Kraaykamp, Tolsma, & Wolbers, 2013), but it may also apply to siblings. The resources connected to the older sibling's field of study can be used by their younger siblings to choose a field of study. For example, younger siblings follow their older siblings' field of study (e.g., nurse) because they can draw upon the skills of their older sibling (i.e., they learn nursing skills) or are exposed to their older sibling's field-specific aspirations (i.e., aspirations to be a nurse) and are most likely embedded in networks that provide them with information on this field (i.e., what does being a nurse entail and how can I become one?). If younger siblings draw upon their older sibling's field-specific resources to choose their field of study, then the likelihood of the younger sibling entering a field of study similar to their older sibling's increases. The theory of direct transfer therefore leads to sibling similarities in fields of study. Note that these field of study choices are not necessarily gendered and that older siblings

therefore do not increase gender differences in fields of study. The few studies that looked at sibling influence in educational choices found support for this line of reasoning. Goodman et al. (2016) and Joensen and Nielsen (2015a, 2015b) found that younger siblings tend to follow their older sibling's choice of school or math and science choices, respectively. Based on the theory of direct transfer, we formulate the expectation that *if the older sibling has chosen a field of study, the likelihood of the younger sibling entering the same field of study increases (H1).*

The theory of direct transfer predicts that a person is more likely to use the resources of an individual with more status (who is more dominant; Hetherington, 1965; Korupp, Ganzeboom, & Van der Lippe, 2002). Siblings who are older in age are likely to have more skills and knowledge, which increases their dominance. This leads to the expectation that younger siblings are more likely to follow their older sibling's field of study when they differ more in age. The same premise should hold for older siblings who are higher educated. Higher-educated older siblings have more skills and knowledge, which increases their dominance. 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 as their younger sibling. We therefore expect that *the positive effect of an older sibling's field of study is stronger when siblings differ more in age (H2) and when the older sibling is higher educated (H3).*

The few studies examining sibling influence in educational choices have focused only on age differences, not differences in educational level, but show no support for these hypothesized effects. Both Goodman et al. (USA: 2016) and Joensen and Nielsen (Denmark; 2015a, 2015b) found that sibling similarities in college choice or math and science choices, respectively, are more likely to occur when siblings are closer in age.

Gender role socialization

Gender role socialization theory helps to explain how older brothers or sisters socialize their younger brothers or sisters into different fields of study. Gender role socialization theory posits that individuals are socialized by their social environment into "appropriate" male or female gender role behaviors (Bussey & Bandura, 1999; Lytton & Romney, 1991; Ridgeway & Smith-Lovin, 1999). In the traditional male gender role, men are breadwinners, more rational and therefore more likely to enter masculine fields like science or technology. In the traditional female gender role, women are homemakers and caregivers and more emotional and verbal, which makes them more likely to enter more feminine fields of study like education, humanities, arts, or social sciences (Davis & Greenstein, 2009; Jacobs & Gornick, 2002). People learn gender role behavior by observing individuals in their social environment, and because siblings spend so much time with each other, they are potentially very important role models. Older siblings can function as gender role models if their field of study is "typical" for their sex category. Younger siblings thus learn "appropriate" male and female gender roles by observing their older sibling's field of study. If younger siblings subsequently conform to these gender roles, then older siblings who have chosen a gender stereotypical field of study might lead their younger sibling to a gender stereotypical field of study. This means that an older brother who is in a gender stereotypical masculine field of study (e.g., science or engineering) will lead his younger brother to a masculine field of study (e.g., science or engineering) but his younger sister to a feminine field of study (e.g., education, humanities, arts, or social sciences). Similarly, an older sister in a gender stereotypical feminine field of study (e.g., education, humanities, arts, or social sciences) will lead her younger brother to a masculine field of

study (e.g., science or engineering) but her younger sister to a feminine field of study (e.g., education, humanities, arts, or social sciences). Research supports the notion that older siblings are important gender role socialization agents (Rust et al., 2000; Updegraff et al., 2000), but there is no research examining how older siblings' field of study might lead their younger brothers or sisters to different fields of study. Based on gender role socialization theory, we formulate the expectation that *an older brother who has chosen a field of study that can be categorized as masculine (feminine) will lead his younger brother to a field of study that can be categorized as masculine (feminine) and his younger sister to a field of study that can be categorized as feminine (masculine)* (H4a). Similarly, we expect that *an older sister who has chosen a field of study that can be categorized as feminine (masculine) will lead her younger brother to a field of study that can be categorized as masculine (feminine) and her younger sister to a field of study that can be categorized as feminine (masculine)* (H4b).

Gender role socialization theory posits that siblings copy their same-sex siblings because it is more likely that boys learn "appropriate" male gender role behavior from boys and girls learn "appropriate" female gender role behavior from girls. Studies focusing on sibling influence support the idea that same-sex siblings are especially important gender role models (Rust et al., 2000; Updegraff et al., 2000). If a younger sibling is more likely to learn gender role behavior from his/her same-sex sibling, than a younger brother is more likely to follow his older brother's (masculine) field of study and a younger sister more likely to follow her older sister's (feminine) field of study. We therefore expect *that an older brother who has chosen a field that can be categorized as masculine (feminine) will lead his younger brother to a field of study that can be categorized as masculine (feminine), whereas he will not influence his younger sister's field of study* (H5a). Similarly, we expect that *an older sister who has chosen a field of study that can be categorized as feminine (masculine) is more likely to lead her younger sister to a field of study that can be categorized as feminine (masculine), whereas she will not influence her younger brother's field of study* (H5b).

The few studies that do focus on field of study-related choices have not been published in peer-reviewed journals (with the exception of Anelli & Peri, 2014). These studies tended to examine whether sibling similarities in field of study depend on the siblings being same-sex or opposite-sex. Although this tells us something about how older siblings might *sustain* gender differences in fields of study, it provides little information on how older siblings *lead to* gender differences in fields of study; in other words, how the influence of older brothers and sisters on their younger brothers and sisters might differ. Moreover, the results of these studies are mixed. Joensen and Nielsen (2015a, 2015b) found that sibling similarities in math and science are more likely to occur in brother pairs. Chen (2016) found no effect of sibling sex composition on college major choice (defined as male-dominated vs all other majors). In contrast to gender role socialization theory, Anelli & Peri (2014) found that same-sex siblings are more likely to enter gender atypical college majors (defined as high-earning majors: economics/business, engineering and medicine) than opposite-sex siblings, who are more likely to enter gender typical fields.

Parents

Although this chapter focuses on the role of older siblings, we know from previous research that parents affect the field of study that their child enters (Kraaykamp et al., 2013; Van de Werfhorst & Luijkx, 2010; Van de Werfhorst et al., 2003). The theory of direct transfer and gender role socialization can also be applied to parents' influence (see chapter 3 of this dissertation). Children

can draw upon their parents' occupational field-specific resources (direct transfer) or learn "appropriate" gender role behavior from their parents' behavior (occupational field; gender role socialization). When it comes to choosing a field of study, however, older siblings could be very influential as well. Given that older siblings went through the process of choosing a field of study more recently than their parents, they might have more up-to-date knowledge and experience in this regard. Qualitative research examining college attendance has provided some evidence that siblings replace parents as information sources when parents were unable to assist (Ceja, 2006; Mwangi, 2015). The focus of this chapter is on the role of older siblings and we therefore control for mother's and father's occupational field.

4.3 Method

Educational system in the Netherlands

Depending on their grades, test results, and teachers' recommendation, students in the Netherlands can enter one of three levels of secondary education (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 that offer professional Bachelor degrees. This level is referred to as higher vocational education (HBO). Only the academic level (VWO; 6 years) prepares students for a research university that offers academic Bachelor and graduate degrees. 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).

Data & sample

This chapter 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, 2016a, 2016b), which aimed to explore the structural, cultural, and social integration of immigrant and non-immigrant children in four European countries. We mainly use the fifth wave collected in 2015 to construct our variables, but some variables are complemented with information from wave 1 (2010/2011) and wave 2 (2011/2012) of the CILS4EU.

The sample in CILS4EU was selected 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, non-responding schools were replaced with other similar schools (school response rate after replacement: 91.7%). In total, 4963 respondents participated in wave 1 and an additional 2127 students participated in wave 2 (overall student

participation rate given wave 1 = 77.5%).[1] In wave 1 and wave 2, most respondents participated by filling in a self-completion questionnaire in their class at school. 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 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 version (approximately 1%).

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[2] people who participated in wave 1 or wave 2, 3759 respondents participated again in wave 5. We selected respondents who entered a field of study, who have one or more older siblings, and whose older sibling or siblings had also entered a field of study. Sibling information was obtained from the respondents, who answered questions about their older or same-age 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. We restructured the data so that all siblings within a family are cases; see table 4.1. In total, we have 1201 respondents with older siblings. Of these 1201, there are 850 with one older sibling (sibling 1 in table 4.1), 296 with two older siblings (sibling 2 in table 4.1) and 55 who have three older siblings (sibling 3 in table 4.1). This allows us to make 1607 sibling dyad pairs for which we can evaluate the influence of older sibling on younger siblings. Siblings are thus nested in families. We excluded twins or siblings born in the same year from our analyses. Our final analytical sample consists of 1607 sibling pairs from 1201 families.

Table 4.1 *Structure of the data before and after restructuring.*

Before restructuring					**After restructuring**		
Family 1	Respondent	Sibling 1	Sibling 2	Sibling 3	Family 1	Respondent	Sibling 1
Family 2	Respondent	Sibling 1	Sibling 2		Family 1	Sibling 1	Sibling 2
					Family 1	Sibling 2	Sibling 3
					Family 2	Respondent	Sibling 1
					Family 2	Sibling 1	Sibling 2

We are interested in the effect of older sibling's field of study on younger sibling's field of study. We show the results for the older sibling who is closest in age (the sibling directly "above" the sibling in terms of age), but perform additional analyses (see section 4.5 under *Multiple siblings*)

[1] Classes changed considerably between wave 1 and wave 2 and because whole classes were surveyed, new students entered the sample (n = 2127).

[2] This number differs from chapter 3 because in chapter 4 we use all new individuals who entered the sample in the second wave and in chapter 3 we used only the new respondents who either filled in an additional newcomer questionnaire or had parents who were participating.

to evaluate the influence of the oldest sibling as well as the possible sequential and cumulative effect of siblings (what happens if you have more than one older sibling?).

Because we used the fifth wave of a longitudinal study, dropouts may have led to selectivity in our sample. Table 4.2 shows the percentage of students in a field of study in 2014/2015 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 split these percentages by boys and girls and by western and non-western 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 the national statistics, we include only the youngest siblings in table 4.2 because we know that these siblings were enrolled in a field of study in 2014/2015 (n = 1201); older siblings might have already graduated. Table 4.2 shows that boys are underrepresented in our sample. We might underestimate the effect of boys, or the remaining boys in our sample could be a selective group. We should therefore be careful about generalizing our results to boys. 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 4.2 *Percentage of students in fields of study in 2014/2015 in secondary vocational education, higher vocational education, and university, split by boys and girls and western and non-western immigrant students. A comparison between national statistics and our analytical sample (youngest sibling only; n = 1201).*

	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
Western	79.53	84.46	86.24
Non-western	20.47	15.54	13.76
Analytical sample			
Total	*49.84*	*33.35*	*16.80*
Male	34.17	34.95	38.83
Female	65.83	65.05	61.17
Western	78.00	83.87	86.17
Non-western	22.00	16.13	13.83

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

Measures

The dependent variable is *younger sibling's field of study* and refers to the field of study in which the younger sibling is currently 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 (including life sciences); 4 = Services (e.g., Security services & Personal services). Appendix C, table C.1 provides a detailed overview of the ISCED fields per category. Based on the percentage of women in fields of study in 2014/2015 derived from Statistics Netherlands (at all levels of education; Statistics Netherlands, 2014, 2015)[3], health, biology, agriculture, and veterinary can be categorized as the most feminine category (73% women), followed by education, humanities, arts, and social sciences (68% women). Services (46% women) and business and law (41% women) can be considered more gender neutral given that they attract similar numbers of boys and girls, and science and engineering can be considered the most masculine category (14% women).

The independent variable *older sibling's field of study* reflects the field of study of the older sibling who is closest in age and is coded using the same categories as the dependent variable.

Age difference reflects the age differences in years between the younger sibling and the older sibling who is closest in age. Because this variable was skewed and only a few siblings differed more than five years, the variable was top-coded at five-year age difference.[4] A higher score indicates a bigger age gap between siblings in years.

Students in the Netherlands enter a field of study in the three different levels: secondary vocational education, higher vocational educational, or university. *Older sibling higher educated* refers to a dummy that reflects whether the older sibling who is closest in age entered a higher level of education (1), versus whether siblings entered a similar level of education or whether the younger sibling entered a higher level of education (0).

Sex composition of sibling dyad is measured by four dummies and indicates the sex composition of the sibling dyad: older sister – younger sister; older brother – younger brother; older sister – younger brother, and older brother – younger sister.

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 similar fields as sibling's field of study: 0 = Education, humanities, arts, and social sciences; 1 = Business and law; 2 = Science and engineering; 3 = Health, biology, agriculture, and veterinary; 4 = Services. Appendix C.2 provides an overview of how the ISCO08 fields are recoded in these five categories. Missing values were replaced with information provided by the respondents, who also answered questions about their parents' main occupation in wave 1 or wave 2. However, respondents reported this information specifically for their biological parents. We therefore only replaced

[3] The numbers from secondary vocational education are not available online. We requested them from Statistics Netherlands. They are available upon request from the authors.

[4] Not top-coding this variable did not alter our results.

missing values when respondents indicated that they lived with their biological mother and/or father in wave 1 or 2 (n = 473 siblings or 345 families).

Controls

We control for gender differences in field of study choices. *Sex younger sibling* refers to whether the younger sibling is a girl (1) or a boy (0). *Age younger sibling* refers to the age of the younger sibling in years. Younger sibling's educational level is coded (0) *secondary vocational education*, (1) *higher vocational education,* and (2) *university*.

Because the data originally contained an oversampling of non-western immigrants, we controlled for *non-western immigrant background*. This variable indicates whether siblings, or one of their parents, were born outside western societies (1) or not (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 (Kraaykamp et al., 2013; Van de Werfhorst et al., 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. In the first and second wave, their children were also asked about their parents' highest level of education: "What is the highest completed educational level of your biological mother/father?". The response categories primary education, secondary education, and university were recoded into the parents' response categories. 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, but only if the children indicated that they lived with their biological parent or parents in wave 1 or 2 (n = 445 siblings or 324 families). Descriptive statistics of all variables can be found in table 4.3.

4.4 Analyses

We analyzed our data 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. Conditional logistic regression generalizes multinomial logistic regression by allowing predictor variables that vary across the field of study options to be incorporated directly. In our study, this is the variable predicting whether an option is, or is not, chosen by the older sibling. To estimate these models,

[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 4.3. *Descriptive statistics (N=1607).*

	Mean	*SD*	*Min*	*Max*
Dependent variable				
Younger sibling's field of study				
Education, humanities, arts, and social sciences	.26		0	1
Business and law	.26		0	1
Science and engineering	.15		0	1
Health, biology, agriculture, and veterinary	.20		0	1
Services	.14		0	1
Independent variables				
Older sibling's field of study				
Education, humanities, arts, and social sciences	.28		0	1
Business and law	.25		0	1
Science & engineering	.18		0	1
Health, biology, agriculture, and veterinary	.17		0	1
Services	.13		0	1
Age difference	2.56	1.32	1	5
Differences in educational level between siblings				
Similar education level/younger sibling higher educated	.67		0	1
Older sibling higher educated	.33		0	1
Sex composition of sibling dyad				
Older sister – younger sister	.32		0	1
Older brother – younger brother	.19		0	1
Older sister – younger brother	.19		0	1
Older brother – younger sister	.30		0	1
Mother's occupational field[a]				
Education, humanities, arts, and social sciences	.22		0	1
Business and law	.30		0	1
Science and engineering	.04		0	1
Health, biology, agriculture, and veterinary	.23		0	1
Services	.21		0	1
Father's occupational field[a]				
Education, humanities, arts, and social sciences	.07		0	1
Business and law	.34		0	1
Science and engineering	.34		0	1
Health, biology, agriculture, and veterinary	.11		0	1
Services	.15		0	1
Controls				
Sex younger sibling (girl = 1)	.62		0	1
Age younger sibling	19.97	2.41	16	38
Level of education younger sibling				
Secondary vocational education and training	.50		0	1
Higher vocational education	.33		0	1
University	.17		0	1
Non-western immigrant background[a]	.21		0	1
Parents' highest educational level[a]	3.13	1.22	0	5

Source: Wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations.
[a] Wave 1 or wave 2 of Children of Immigrants Longitudinal Survey in Four European Countries, own calculations.
Note: For categorical variables, proportions are given.

we further restructured our data. For each sibling pair (N = 1607), we created five lines, one for each category of field of study. The variable *older sibling's field of study* then reflects the field of study chosen by the older sibling (1) vs the fields he/she has not chosen (0). Other predictor variables such as sex or age of younger sibling that do not vary across the options have been included as an interaction with the possible options. This controls for the likelihood that boys or girls, for example, will study one particular field rather than a reference category (in our case education, humanities, arts, and social sciences). The dependent variable is the variable *younger sibling's field of study* rewritten as the field chosen by the younger sibling (1) vs the fields he/she did not choose (0). The conditional logit models that we estimated thus focus on the likelihood of ending up in the same field as the older siblings versus any other field (much like mobility models used in stratification research: Hendrickx & Ganzeboom, 1998; Van de Werfhorst, De Graaf, & Kraaykamp, 2001).

Because our data are hierarchically structured – siblings are nested within families – we clustered standard errors to take into account the dependency of our data.[6]

We estimated four models that test our hypotheses and the results can be found in table 4.4. Model 1 tests whether older sibling's field of study increases the likelihood of the younger sibling entering the same field of study (H1). In model 2 we test whether this expected positive effect depends on age differences between siblings (H2), and in model 3 whether it depends on the older sibling being higher educated (H3). In model 4, we add a three-way interaction between *sex composition of sibling dyad, older sibling's field of study*, and all fields of study categories. This model tests whether an older brother who has chosen a field of study that can be categorized as masculine (feminine) will lead his younger brother to a field of study that can be categorized as masculine (feminine) and his younger sister to a field that can be categorized as feminine (masculine) (H4a). Similarly, this model tests whether an older sister who has chosen a field of study that can be categorized as feminine (masculine) will lead her younger sister to a field of study that can be categorized as feminine (masculine) and her younger brother to a field that can be categorized as

[6] There are several ways to take into account the dependency of the data, each with its own pros and cons. We tried the alternatives but these models were hard to estimate due to limitations in the data. One alternative would be multinomial logistic regression with fixed effects that control for (unmeasured) family effects. In fixed-effects models, family-level variables that are fixed (i.e., do not vary among family members) are excluded from the equation and do not bias the estimates of sibling influence. Fixed-effects models thus control for a family-specific tendency (for example that comes from a high socio-economic status) to choose a certain field of study. However, in our case, multinomial logistic regression with fixed effects creates two major difficulties. On the one hand, the independent variables do not differ for a large percentage of the siblings and as fixed-effects models look at differences within families, this method was an especially inefficient way to test our hypotheses. On the other hand, a multinomial logistic regression would give us unreliable estimates due to the number of parameters being estimated based on a limited sample (e.g., five field of study options on the independent side and five on the dependent side, not even including the interactions). A conditional logit analysis allows us to reduce the number of parameters that need to be estimated.

A second approach would be random-effects models. These are similar to fixed effects in that they control for a family-specific tendency to choose a field of study. However, it assumes that these family-specific tendencies are uncorrelated and that random effects are normally distributed, which might not be the case in our data. Additionally, the results would also give us unreliable estimates because we lack sufficient power to estimate these models.

masculine (feminine) (H4b).[7] This model also allows us to see whether brothers are more likely to influence brothers and sisters to influence sisters (H5a/H5b). Because parents' occupational fields had numerous missing values, we ran separate analyses in which we controlled for mother's and father's occupational field.[8] These results are shown in table 4.5. All results are shown in terms of log-odds. For practical reasons, we do not display the effect of the control variables. These can be found in appendix C, table C.3 (but only for table 4.4 since the control variable effects for table 4.5 were highly similar).

4.5 Results

Model 1 in table 4.4 estimates the likelihood of choosing the same field as the older sibling compared to any other field. In support of hypothesis 1, this model shows that if the older sibling has chosen a field of study, the odds of the younger siblings choosing a similar field rather than any other field are more than 1.70 [exp(0.53= 1.70)] times higher. We also tested whether the effect of older sibling's field of study varies across fields by including a moderation between *older sibling's field of study* and all fields of study categories (model not shown). The positive effect of older sibling's field of study remains and the interactions were not significant. A joint Wald test shows that these interaction effects do not differ from 0 (Wald $\chi^2(4) = 4.06, p = .40$), meaning that the likelihood of the younger sibling choosing a similar field does not depend on which field of study the older sibling has chosen. In models 2 and 3 we therefore focus on sibling similarities in fields of study and not on the specific field that was chosen by the older sibling.

In model 2 we add the interaction between older sibling's field of study and age differences to test whether sibling similarities are more likely when there is a larger age gap between siblings (H2). The odds of choosing a field – in case of no age differences – are more than 1.5 times [exp(0.50 = 1.65] higher if the older sibling has also chosen this field but the interaction term is not significant. Moreover, the likelihood ratio test shows that model 2 is not a significant improvement over model 1 ($\chi^2(1) = 0.06, p = .81$). These results do not support hypothesis 2.

Model 3 includes the interactions between older sibling's field of study and whether or not the older sibling is higher educated. We find no support for hypotheses 3 stating that sibling similarities are stronger when older siblings are higher educated. A likelihood ratio test also shows that model 3 is not a significant improvement over model 1 ($\chi^2(1) = 1.30, p = .25$).

Model 4 tests hypotheses 4 and 5 by including a three-way interaction between *older sibling's field of study, sex composition of sibling dyad*, and all fields of study categories. This model is not a significant improvement over model 1 ($\chi^2(27) = 19.61, p = .84$). The three-way interactions are not significant and a joint Wald test shows that these three-way interaction effects do not differ from 0 (Wald $\chi^2(12) = 4.27, p = .98$). This refutes H4a & H4b, which state that that the influence of an

[7] In model 4, the variable *girl* is excluded because the interaction of sex composition of sibling dyad with the field categories automatically controls for gender differences in fields of study.

[8] 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.

Table 4.4 *Results of conditional logit models (log-odds) of how older sibling's characteristics affect younger sibling's field of study (N = 1607).*

	Model 1	Model 2	Model 3	Model 4
Older sibling's field of study	0.53***	0.50***	0.57***	0.71***
(1: option chosen 0: not chosen)	(0.06)	(0.12)	(0.07)	(0.20)
Older sibling's field of study ×				
Age differences		0.01		
		(0.04)		
Older sibling higher level of education			-0.14	
			(0.12)	
Similar level of education/younger sibling higher level of education			-	
Older brother - younger brother				0.12
				(0.43)
Older sister - younger brother				-0.03
				(0.41)
Older brother - younger sister				-0.18
				(0.31)
Older sister - younger sister (ref)				-
Older brother - younger brother ×				
Business and law				0.38
				(0.62)
Science and engineering				-0.51
				(0.76)
Health, biology, agriculture, and veterinary				0.22
				(0.73)
Services				-0.17
				(0.71)
Education, humanities, arts, and social sciences (ref)				-
Older sister - younger brother ×				
Business and law				0.41
				(0.61)
Science and engineering				-0.66
				(0.98)
Health, biology, agriculture, and veterinary				-0.02
				(0.65)
Services				0.36
				(0.65)
Education, humanities, arts, and social sciences (ref)				-
Older brother - younger sister ×				
Business and law				0.44
				(0.51)
Science and engineering				-0.91
				(0.78)
Health, biology, agriculture, and veterinary				-0.02
				(0.55)
Services				-0.17
				(0.61)
Education, humanities, arts, and social sciences (ref)				-
Older sister - younger sister × all fields (ref)				-
Older sibling's field of study ×				
Business and law				-0.59
				(0.36)
Science and engineering				0.66
				(0.58)
Health, biology, agriculture, and veterinary				-0.12

				(0.35)
Services				-0.40
				(0.39)
Education, humanities, arts, and social sciences (ref)				-
Log likelihood	-2261.04	-2261.01	-2260.38	-2251.23
df	29.00	30.00	30.00	56.00
χ^2	460.80	461.35	460.01	483.86

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. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

older sibling's field of study differs across the sexes of the sibling dyad depending on which (masculine or feminine) field of study the older sibling has chosen. This also means that there are no specific same-sex effects. We find no evidence that an older brother who has chosen a field that can be categorized as masculine will lead his younger brother to a field of study that can be categorized as masculine whereas his field of study does not influence his younger sister's field of study (H5a), or that an older sister who has chosen a field of study that can be categorized as feminine will lead her younger sister to a field of study that can be categorized as feminine whereas her field of study does not influence her younger brother's field of study (H5b). We additionally tested whether sibling similarities in field of study choices depend on the sex composition of the sibling dyad (model not shown), irrespective of the (masculine or feminine) field chosen by the older sibling, but found no such evidence.

Table C.3 in appendix C shows the effect of the control variables. We see that older siblings (higher in age) are less likely to enter business and law than enter 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 services over education, humanities, arts, and social science. University students are less likely than students in secondary vocational education to study 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 about 6% [exp(-2.77 = .06)] of the odds for girls compared to boys. Lastly, individuals with a non-western immigrant background are more likely than their western peers to choose business and law over education, humanities, arts, and social science.

Parents

To test whether the effect of older sibling's field of study is 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 4.5. In all models, children are more likely to enter a field of study similar to their father's occupational field and this effect is similar for all occupational fields in which the father is employed (model not shown: Wald $\chi^2(4) = 8.49$, $p = .08$). The odds of a child choosing a field are around 1.35 [exp(0.30 = 1.35)] higher for the option chosen by their father. This effect is smaller than we found for the older sibling who is closest in age (around 1.70 times). When we include an

Table 4.5 *Results of conditional logit models (log-odds) of how older sibling's characteristics affect younger sibling's field of study, controlled for mother's and father's occupational field (n = 1014).*

	Model 1	Model 2	Model 3	Model 4
Older sibling's field of study	0.44***	0.39*	0.50***	0.90***
(1: option chosen 0: not chosen)	(0.07)	(0.16)	(0.09)	(0.25)
Older sibling's field of study ×				
Age differences		0.02		
		(0.06)		
Older sibling higher level of education			-0.18	
			(0.16)	
Similar level of education/younger sibling higher level of education			-	
Older brother - younger brother				-0.59
				(0.54)
Older sister - younger brother				-0.23
				(0.52)
Older brother - younger sister				-0.32
				(0.40)
Older sister - younger sister (ref)				-
Older brother - younger brother ×				
Business and law				1.25
				(0.78)
Science and engineering				1.43
				(1.27)
Health, biology, agriculture, and veterinary				0.91
				(0.96)
Services				0.88
				(0.89)
Education, humanities, arts, and social sciences (ref)				-
Older sister - younger brother ×				
Business and law				0.65
				(0.75)
Science and engineering				1.06
				(1.38)
Health, biology, agriculture, and veterinary				0.46
				(0.86)
Services				0.97
				(0.82)
Education, humanities, arts, and social sciences (ref)				-
Older brother - younger sister ×				
Business and law				0.39
				(0.66)
Science and engineering				0.78
				(1.27)
Health, biology, agriculture, and veterinary				0.19
				(0.71)
Services				-0.17
				(0.79)
Education, humanities, arts, and social sciences (ref)				-
Older sister - younger sister × all fields (ref)				-
Older sibling's field of study ×				
Business and law				-0.75
				(0.45)
Science and engineering				-0.89
				(1.10)
Health, biology, agriculture, and veterinary				-0.84

				(0.45)
Services				-0.83
				(0.51)
Education, humanities, arts, and social sciences (ref)				-
Mother's occupational field	0.02	-0.00	-0.00	0.00
	(0.08)	(0.08)	(0.08)	(0.08)
Father's occupational field	0.34***	0.30***	0.30***	0.30***
	(0.09)	(0.09)	(0.09)	(0.09)
Log likelihood	-1402.07	-1402.07	-1401.44	-1391.37
df	31.00	32.00	32.00	58.00
χ^2	341.22	341.27	341.38	369.04

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. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

interaction with father's occupational field and sex of the younger sibling (results not shown), we see that this effect is only present for boys. The odds of sons choosing a field are more than 1.52 times [exp(0.42 = 1.52)] higher for the option chosen by their father and this effect does not differ significantly from the effect of an older sibling's field of study (Wald $\chi^2(1) = 0.02, p = .89$). Mother's occupational field does not affect the field of study her child enters. An important conclusion from these analyses is that sibling's field of study is more relevant than parents' occupational field and that the results do not differ substantially from those reported in table 4.4.

Multiple siblings

We have shown the influence of the older sibling who is closest in age. If there are multiple siblings, however, the oldest sibling may also be the most influential. For example, the oldest sibling differs more in age, implying that he/she might be more dominant (higher in status) than the older sibling who is closest in age and therefore the most influential. All analyses were performed again with variables that include the influence of the oldest sibling (table C.4 in appendix C; $N = 1607$). Table C.4 shows that younger siblings tend to follow their oldest sibling's field of study, and that the effects are highly comparable to our main analyses. The effect of oldest sibling's field of study also does not differ depending age differences (model 2), education level of the oldest sibling (model 3), or across sex composition of the sibling dyad depending on the field of study the oldest sibling has chosen (model 4). These results, however, may be similar to our main analyses because many oldest siblings are also the siblings closest in age. We therefore performed all analyses again excluding siblings whose oldest sibling is also the closest in age (table C.5 in appendix C; $n = 406$). Overall, the results in table C.5 are smaller and weaker, probably also owing to the lower number of respondents in these analyses. Model 1 indicates that the odds of choosing a field are around 1.57 [exp(0.45 = 1.57)] higher for the option chosen by the oldest sibling, which is only slightly weaker than the effect of the oldest sibling closest in age (1.70). Overall, table C.4 and C.5 show that younger siblings are also more likely to follow the field of study chosen by their *oldest* sibling, but to a slightly lesser extent than the field of study of their older sibling closest in age. We only showed the variables of interest in tables C.4 and C.5, since the effect of control variables resembled those reported in the main analyses.

Lastly, siblings might have sequential or cumulative effects. It might be that if sibling A copies B, and B copies C, the influence of A on C runs via B (sequential). Moreover, the effect of the field of study of (one of) the older sibling(s) could become stronger when another older sibling

also studies that field (cumulative). These analyses are only possible for siblings who have more than one older sibling (n = 406). However, to increase the number of participants in these analyses, we set the effect of older sibling's field of study to 0 for siblings who do not have multiple older siblings. The main independent variable in these analyses is the field of study chosen by the older sibling (1) vs all the fields he/she did not choose *or* when the sibling does not have multiple older siblings (0). Table C.6 in appendix C shows the direct effect of the field of study of the sibling who is closest in age (model 1), the direct effect of the field of study of the subsequent older sibling (variable named *field of study sibling second closest in age*; model 2), and the direct effect of the field of study of the older sibling who is third closest in age (variable named *field of study sibling third closest in age*; model 3). Because we have concluded that it does not matter which field of study older siblings has chosen and to reduce the number of parameters, we do not differentiate between the different fields chosen by older siblings. We conclude that younger siblings tend to follow the field of study of the older sibling who is closest in age (model 1) and the field of study of the subsequent older sibling (model 2), but not of the third older sibling (model 3). However, since the effect size does not differ that much from that of the sibling closest in age (model 1) or the subsequent older sibling (model 2), and because we concluded that the oldest sibling is also influential, the lack of significance could also be due to the small number of individuals who have three older siblings (n = 55). Model 4 includes both the field of study of the sibling who is closest in age and the field of study of the sibling who is second closest in age. Model 5 includes the direct effects of all three older siblings. Model 4 is a significant improvement over model 1 ($\chi^2(1) = 75.50$, $p < .001$) and model 2 ($\chi^2(1) = 11.91$, $p < .001$). If sibling effects are sequential, the effect of the field of study of the sibling who is second closest in age (model 2) should become non-significant or smaller when adding the field of study of the sibling who is closest in age (model 4). In our model, however, this effect becomes only slightly smaller and remains significant. A Wald test shows that the effect of the field of study of the sibling closest in age does not differ from the effect of the field of study of the sibling second closest in age (Wald $\chi^2(1) = 0.61$, $p = .44$). This means that not only the field of study of the sibling closest in age matters, but also that of the subsequent older sibling. Adding the third sibling to model 5 does not change these effects. Model 5 is also not a significant improvement over model 4 ($\chi^2(1) = 2.10$, $p = .15$).

Models 6 and 7 include interactions between the fields of study of the older siblings to test cumulative effects of siblings. Model 6 includes the interaction between the field of study of the older sibling who is closest in age and the subsequent older sibling. This model is no significant improvement over model 4 ($\chi^2(1) = 0.02$, $p = .88$) and the interaction is not significant. This means that the likelihood of choosing the same field as the older sibling who is closest in age – compared to any other field or to not having multiple older siblings – does not change when the subsequent older sibling also chose that same field. Model 7 also includes interactions between the field of study of the older sibling who is third closest in age. This model is not a significant improvement over model 6 ($\chi^2(1) = 7.71$, $p = .10$), meaning that siblings do not have cumulative effect.

Overall, younger siblings tend to follow their older siblings' field of study and their fields of study do not have sequential or cumulative effects. The effect of an older sibling's field of study is strongest for the older sibling closest in age, but the subsequent older sibling is also important. Moreover, even though the effect of the field of study of the sibling who is third closest in age is

not significant, we conclude that the *oldest* sibling does have an influence and the lack of significance could result from the low number of respondents with three older siblings.

4.5 Conclusion and discussion

This study evaluated how older siblings affect a younger sibling's field of study after secondary education in the Netherlands. Based on the theory of direct transfer, we argued that younger siblings enter similar fields of study as their older sibling, especially when siblings differ more in age and when the older sibling is higher educated. Based on gender role socialization theory, we argued that older siblings lead to gender differences in fields of study because younger siblings learn "appropriate" gender role behavior from their older brother's or sister's field of study. We also tested whether younger siblings were more likely to learn gender role behavior from their same-sex sibling. We used the fifth wave of CILSNL data and analyzed 1607 sibling pairs using conditional logit models.

Congruent with the theory of direct transfer as well as previous findings on sibling influence in educational choices (Goodman et al., 2016; Joensen & Nielsen, 2015a, 2015b), younger siblings follow their older sibling's field of study. This suggests that younger siblings use their older sibling's field-specific resources when they choose a field of study. Although previous research mainly used this argument for the intergenerational transmission of occupational field-specific resources (Jonsson et al., 2009; Kraaykamp et al., 2013; Van de Werfhorst & Luijkx, 2010), our results show that it also applies to siblings. The effect of older sibling's field of study was present irrespective of either mother's or father's occupational field. The influence of older sibling's field of study was equally large as that of father's, whereas mothers did not affect field of study choices. In line with some qualitative research examining college attendance, this indicates that besides parents, siblings can be important information sources for entering fields of study (Ceja, 2006; Mwangi, 2015). The fact that younger siblings follow their older siblings' field of study implies that when interventions meant to increase the number of individuals choosing certain fields of study target one child in the family, they may have indirect effects on that child's younger siblings.

Gender role socialization does not seem to explain sibling influence in fields of study. An older brother or sister who is in a gender stereotypical masculine (e.g., science or engineering) or feminine (e.g., education, humanities, arts, or social sciences) field of study does not influence his/her younger sibling to choose a more gender stereotypical field of study. Older siblings play an important role in the field of study younger siblings enter, but they do not contribute to gender differences in fields of study. This is a particularly important finding because it indicates that siblings provide the opportunity to learn cross-gendered behaviors in "peer-like" relationships during adolescence, when sex segregation is pervasive in the peer context (Mehta & Strough, 2009). However, this study may lack support for gender role socialization theory because the number of parameters used in the analyses testing this theory was quite large given the number of respondents included in those analyses. The fact that older siblings do not lead to gender differences in fields of study also means that although interventions targeted at siblings could increase the number of individuals in certain fields, they do not reduce gender segregation in educational fields.

While we have established that younger siblings follow their older siblings' field of study, our results are inconclusive as to the conditions under which older siblings exert more influence. Contrary to the theory of direct transfer, sibling similarities are not more likely to occur when siblings differ more in age or when the older sibling is higher educated. We also conclude that sibling influence does not depend on which field older siblings have chosen, suggesting that older siblings' resources in one field (e.g., economics) are not more useful than those in other fields (e.g., humanities). Furthermore, other studies have highlighted that sibling influence in field of study choices was stronger among brother pairs (Joensen & Nielsen, 2015a, 2015b) or mixed-sex siblings (Anelli & Peri, 2014), but in line with Chen (2016), we conclude that the sex composition of the sibling dyad does not matter. Possible avenues for future research include exploring whether sibling influence is larger when siblings live together or the amount of time they spend together because the opportunity to influence is larger. Another avenue would be to see how sibling similarities in fields of study depend on the relationship quality between siblings, because sibling influence may be stronger when siblings have a close bond (Slomkowski et al., 2005; Whiteman & Christiansen, 2008). Additionally, it would also be interesting to explore under what conditions *which* sibling is more influential for field of study choices. We find not only that the sibling closest in age matters for younger sibling's field of study choice, but also subsequent older siblings (in line with Goodman et al., 2016) and these effects are not sequential (sibling A influences C via B) or cumulative (effect of A on C is stronger when B studies the same field as A). Living together, spending more time together or relationship quality could then also be important. Adolescents often leave the household when they have chosen a field of study, which could make an older sibling who has not left particularly influential. It could also be that the younger sibling is influenced most by the sibling with whom he/she spends the most time and/or to whom he/she is closest.

We also encourage future research to measure the underlying mechanisms of sibling influence in fields of study. 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). We find no support for these claims, but we cannot rule out that both direct transfer and sibling de-identification mechanisms underlie sibling influence on fields of study. If both occur, effects might cancel each other out. It is important to disentangle these mechanisms by measuring them.

We were unable to rule out potential non-causal explanations for the effect of older sibling's field of study on his/her younger sibling. The analyses may not have controlled sufficiently for fundamental differences between families that determine which fields of study students enter. If the analyses did not completely absorb such inter-family differences, then the relationship between siblings' fields of study may be picking up some of those unobserved differences. We tried to overcome this limitation by controlling for certain family effects (non-western immigrant background and socio-economic status) and by controlling for parents' occupational field.

However, we encourage future research exploring sibling influence on field of study choice to control for family and/or parents' characteristics.

In sum, consistent with the theory of direct transfer, younger siblings follow their older sibling's field of study. We find this for the sibling closest in age, but also for subsequent older siblings. The likelihood of sibling similarities does not depend on differences in age or educational level between siblings, nor do we find any evidence that older siblings contribute to gender differences in educational fields. Our results imply that if we want more individuals to enter certain fields, interventions targeting one child in the family may have indirect effects on that child's younger siblings too.

Chapter 5

Friends with benefits. The importance of friends for stopping the leaking pipeline for girls in STEM choices*

Abstract

Although more women are now entering male-dominated fields of study, they remain underrepresented in science, technology, engineering, and mathematics (STEM). This chapter examines how STEM choices after secondary education are affected by friends' traditional gender norms and the gender composition of the friend group. Using three waves of the Children of Immigrants Longitudinal Survey (N = 744), our sample consists of adolescents who are in a STEM track in secondary education, giving us a better understanding of gender-specific STEM dropouts when students choose a field of study. Logit regression analyses show that the average likelihood of choosing STEM decreases when girls have friends with more traditional gender norms, whereas boys are more likely to enter STEM fields when they have more same-sex friends. Our findings indicate the presence of gender normative views of STEM as being incongruent with female gender role behavior, pushing women out of the STEM pipeline.

Keywords: STEM, Gender, Field of study, Friends' gender norms, Gender composition.

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5.1 Introduction

Women have made tremendous inroads into higher education and the labor market in recent decades. Nevertheless, women are still underrepresented in science, technology, engineering and mathematics (STEM), fields that they tend to leave throughout their educational and labor market careers, although numerous policy efforts have aimed to increase their presence (Barone, 2011; Charles & Bradley, 2009; Mann & DiPrete, 2013). The tendency of women to drop out from STEM fields throughout their educational and occupational path is often referred to as a "leaky pipeline" (Alper, 1993; Mann & DiPrete, 2013; Morgan, Gelbgiser, & Weeden, 2013; Riegle-Crumb et al., 2012; Xie & Shauman, 2003). It is undesirable, causing societies to miss out on talented girls in fields that are considered critical for economic innovation and productivity. Having more women in STEM increases creativity, productivity, and innovation (Corbett & Hill, 2015). Moreover, many talented girls miss out on the professional status and high earnings that STEM careers offer.

Explanations of gender differences in STEM choices have traditionally focused on academic performance and/or ability as well as aspects related to the social environment (e.g., like parents, teachers and classrooms). In this context, findings have clearly shown that the gender gap in STEM cannot be explained solely by disparities in abilities (Ceci, Williams, & Barnett, 2009; Hyde, Lindberg, Linn, Ellis, & Williams, 2008; Mann & DiPrete, 2013). With respect to the social environment, research shows that, besides the home environment, the school environment is particularly important for adolescents' STEM-related educational performance and educational choices. For example, school-specific factors (school resources, quality of teachers, etc.; Eccles, 2011; Legewie & DiPrete, 2014; Xie et al., 2015) and friends and/or classmates influence each other's educational outcomes in the school context (i.e., grades: Kelly, 2008; GPA, math test scores, and algebra placement: Cook et al., 2007; reading test scores: Legewie & DiPrete, 2012; college aspirations and attendance: Hallinan & Williams, 1990). Surprisingly, so far research has been less interested in the (gender-specific) impact of classroom friends on students' STEM choices after secondary education (the exception being enrollment in math courses in secondary education: (Crosnoe, Riegle-Crumb, Field, Frank, & Muller, 2008; Frank et al., 2008; Riegle-Crumb, Farkas, & Muller, 2006). However, research shows that during adolescence, peers grow more important compared to parents or teachers (Ganotice & King, 2014). Therefore, this study considers whether and in what way classroom friends might matter for gender-specific STEM choices after secondary education.

We explore two possible ways that this could happen. The first is the gender normativity of the environment in which boys and girls are situated and which might endorse gender-appropriate behavior (Dasgupta & Stout, 2014). Girls may shy away from STEM because they are restrained by gender norms, leading them to see STEM as incongruent with female gender role behavior (Buck et al., 2008). Although the important role of gender norms is often acknowledged (Gabay-Egozi, Shavit, & Yaish, 2014), the role of friends' gender norms is mostly assumed and not formally tested (e.g., Frank et al., 2008). The second is the gender composition of the friend group. Research shows contradictory evidence for whether boys and girls are more likely to choose gender stereotypical fields of study when they have more same-sex friends (Pahlke et al., 2014) or opposite-

sex friends (Leaper & Smith, 2004), or for whether the gender composition of the friend group works differently for boys and girls (Anelli & Peri, 2013; Favara, 2012).

We use three waves of the Dutch sample of the Children of Immigrants Longitudinal Survey (CILS, $N = 744$), which surveyed adolescents in secondary education (at age 16, 2011/2012) and thereafter (at age 18 in 2014 and 19 in 2015). In the Netherlands, students already make a STEM-related track choice *in* secondary education (in 8th or 9th grade; age 14 or 15), allowing them to enter STEM fields *after* secondary education. We focus specifically on students who have chosen a STEM-related track (i.e., are in the STEM pipeline) in secondary education and examine how friends affect their STEM/non-STEM choices after secondary education, which is an important moment for gender-specific leakage in the STEM pipeline (Zarrett & Malanchuk, 2005). Second, whereas in other countries STEM choices are made mostly in tertiary education (for example choice of major in the USA; Legewie & DiPrete, 2014; Ost, 2010), students in the Netherlands who intend to continue their education after secondary school must choose a field of study, regardless of the educational track they are following in secondary education. Our data thus provides us with the unique opportunity to evaluate how characteristics of classroom friends are associated with STEM choices for a wider group than only students in tertiary education.

5.2 Theory

The gender gap in STEM choices

Research demonstrated that there are gender differences in math/science interest and career aspirations, as well as in actual participation in STEM educational programs and occupations in a wide range of industrialized countries (DiPrete & Buchmann, 2013; Xie et al., 2015). Our starting hypothesis, then, is that *girls, compared to boys, are less likely to choose STEM after secondary education* (H1).

The gender normativity of the environment

One explanation for why gender differences arise in fields of study is related to the gender normativity of adolescents' social environment. The environment in which boys and girls are socialized plays a crucial role when it comes to cultural beliefs about "appropriate" male or female behavior. Traditional gender norms convey that girls are more talented verbally, have better social skills (communal), and are more focused on children and family (Konrad, Ritchie, Lieb, & Corrigall, 2000; Nosek et al., 2009). By contrast, boys are assumed to be good at mathematics and science, agentic (e.g., acquire mastery, skills, competence), and more focused on financial gain and status (Diekman et al., 2010; Nosek et al., 2009). With their focus on science and mathematics, STEM fields are therefore often considered to be part of male gender role behavior and incongruent with female gender role behavior (Buck et al., 2008; Cheryan et al., 2013; Hill et al., 2010). Research shows that adolescents are biased against girls when it comes to mathematics and science (Kurtz-Costes et al., 2014). Living in an environment in which more traditional gender role beliefs are prevalent may activate or reinforce the male stereotyping of STEM fields, and consequently push young women away from STEM (Cech, Rubineau, Silbey, & Seron, 2011; Charles & Bradley, 2009; Charles, Harr, Cech, & Hendley, 2014; Legewie & DiPrete, 2014; Morgan et al., 2013). Friends play a crucial role by approving or disapproving of the adoption of gender-conforming role behavior.

Friends reinforce gender stereotypical behavior and penalize non-conformity (Hannover & Kessels, 2004; Kessels, 2005). For example, Kessels (2005) shows that boys penalized non-conformist gender role behavior by disliking girls whose favorite subject was physics (part of male gender role behavior) and boys whose favorite subject was music (part of female gender role behavior). By contrast, girls disliked peers who favored physics and liked peers who favored music, regardless of sex. Girls who excelled in physics did report feeling unpopular. To fit in and/or to avoid penalties, adolescents are more likely to conform to gender role behavior when they have friends who have more traditional gender normative ideas. As STEM fields are considered part of male gender role behavior and incongruent with female gender role behavior, a more traditional environment can lead to gender differences in STEM choices. We therefore hypothesize that *having friends with more traditional gender norms is associated with a lower likelihood of girls choosing STEM fields, and with a higher likelihood of boys choosing STEM fields* (H2).

Gender composition

There are two ways in which the composition of an adolescent's friend group (more female/male friends) can affect gender differences in STEM fields. First, scholars have argued that individuals are more likely to comply with gender-typed norms in same-sex groups than in mixed-sex groups (Drury et al., 2013; Hilliard & Liben, 2010; Martin & Fabes, 2001). Gender becomes more salient when adolescents have more same-sex friends, since the division between their "own" gender and the "other" gender is more pronounced. Consequently, same-sex friends may activate gender-conforming behavior or penalize non-conformity. Because STEM fields are congruent with male gender role and incongruent with female gender role behavior, this would lead to more gender differences in STEM fields. Therefore, we expect that *a higher share of same-sex friends is associated with a lower likelihood of girls choosing STEM fields, and with a higher likelihood of boys choosing STEM fields* (H3A).

Second, research shows that having same-sex friends might lessen the need to conform to gender norms, leading to less gender stereotypical educational choices for both boys and girls (Francis, Hutchings, Archer, & Melling, 2003; Pahlke et al., 2014; Schneeweis & Zweimüller, 2012). In a more female environment, girls are less marginalized by boys and have more freedom to explore gender atypical interests and abilities. This would imply that girls might explore their math/science abilities and interests more when they are in a more female-dominated environment, which could consequently lead to more STEM choices for girls. For example, using Austrian data collected among 14-year-olds, Schneeweis and Zweimuller (2012) found that girls are more likely to choose a technical school if, in previous grades, they attended a school with a higher percentage of female students. There is much less research on how this works for boys. However, following this line of reasoning, boys in a male-dominant environment would be less marginalized by girls and feel more freedom to explore gender atypical interests, lowering the likelihood of them choosing STEM fields. Based on this argument, we would expect that *a higher share of same-sex friends is associated with a higher likelihood of girls choosing STEM fields, and with a lower likelihood of boys choosing STEM fields* (H3B).

In general, the evidence is inconclusive and seems to support the first argument more for boys (H3A), whereas it appears to be more in line with the second argument for girls (H3B). For example, Favara (2012) concludes that single-sex education leads to more gender atypical field choices for girls (see also Schneeweis & Zeimuller, 2012; H3B), whereas a single-sex environment

reinforces the choice of stereotypically male subjects for boys (H3A; see also Anelli & Peri, 2014). These findings are also in line with research that shows that boys are rebuked more severely than girls for exhibiting gender atypical behavior and feel more social pressure (at least from their male friends) to behave in gender normative ways (Carter & McCloskey, 1984; Fagot, 1977; Simpson, 2005). In sum, it seems that girls who have more same-sex friends feel less marginalized by boys for exploring gender atypical interests (H3B), whereas boys feel more pressure to conform to gender role behavior when they have more same-sex friends (H3A).

5.3. Method

The educational system in the Netherlands

In the Netherlands, secondary education begins at the age of 12 and is compulsory until obtaining a "starting qualification" at the upper secondary level (age 17 or 18). Depending on their grades, test results, and teachers' recommendations, students in the Netherlands can enter one of three possible levels in secondary education. The VMBO or vocational level (4 years) provides access to secondary vocational education (MBO). The two other levels provide access to higher education. The HAVO or general level (5 years) prepares students to enter universities of applied sciences that offers professional Bachelor degrees. The VWO or academic level (6 years) prepares students to enter a research university that offers academic Bachelor degrees.

During secondary education, students choose one of four subject trajectories emphasizing a certain field of study, in addition to satisfying the general educational requirements. Vocational level students make this track choice at the end of their second year (grade 8; age 14) and choose between four trajectories: Health & Wellbeing, Economics, Agriculture, and Technology. Students on the general and academic level make their choice at the end of their third year of secondary school (grade 9; age 15) and they choose between four trajectories: Culture & Society, Economics & Society, Science & Health and Science & Technology or a combination of these trajectories (usually Culture & Society with Economics & Society and Science & Health with Science & Technology). STEM tracks are Technology in the vocational level and Science & Technology or Science & Health in the general and academic level. In the Technology track of the vocational level, mathematics is mandatory and there is a focus on science and physics. The Science & Technology track in the general and academic level focuses on mathematics, chemistry, and physics, whereas the Science & Health track focuses on mathematics, chemistry, and biology.

To finish compulsory education, students in the vocational level go on to secondary vocational education (MBO) for at least two years and choose their field of study when they enter MBO (age 16). Students who finish the general level (age 17) and the academic level (age 18) have completed compulsory education; only students who go on to tertiary education (most of them do) choose a field of study.

It is more difficult to enter STEM after secondary education in the Netherlands compared to other countries (for example Sweden; Van Langen & Dekkers, 2005). Most STEM-related study programs (such as mechanical engineering) require the student to have finished a STEM track in secondary education (in this case Science & Technology or Science & Health). To examine the mechanism leading to the leaking pipeline in greater depth, and also because secondary students

who do not choose a STEM track are very unlikely to end up in a STEM field later, we focus on students who have already opted for a STEM track in secondary education: students who chose Technology in the vocational level and Science & Technology or Science & Health (or a combination of these two) in the general or academic level.

Data

We use the Dutch data sample drawn from the project "Children of Immigrants Longitudinal Study in Four European Countries" (CILS4EU; Kalter et al., 2014, 2016a, 2016b) and the follow-up of this project in the Netherlands, "Children of Immigrants Longitudinal Survey in the Netherlands" (CILSNL; Jaspers & van Tubergen, 2014, 2015b). From the CILS4EU, we use the second wave collected in 2011/2012, when adolescents were 16 years old and in 10th grade (fourth year of secondary education). From CILSNL we use the fourth and fifth waves of data collected in 2014 and 2015, when adolescents were 18 or 19 years old and most of them had chosen a field of study. In wave 4 (2014), adolescents in the general level (which lasts 5 years) had left secondary education and those who continued their education had entered a field of study. In wave 5 (2015), adolescents in the academic level (which lasts 6 years) had left secondary education and those who continued had chosen a field of study. Students in the vocational level (which lasts 4 years) had chosen their field of study in wave 3. However, because they were not queried about their field of study in wave 3, we used the field of study designation from wave 4 for adolescents in the vocational level. The independent variables (e.g., friends' characteristics) and control variables are measured in wave 2 and the dependent variable (e.g., field of study) is measured in wave 4 or 5, depending on when students make a field of study choices. Classes in the Netherlands remain relatively stable after students make their track choice in secondary education. We can therefore adequately evaluate how characteristics of classroom friends in wave 2 are associated with adolescents' STEM choices in wave 4 or 5.

In wave 1, students were selected based on a stratified sample (by educational level and percentage of non-western immigrants in a school). The initial response rate at school level was 34.9%. To increase the response rate, schools that had refused were replaced with similar alternative schools, leading to a response rate of 91.7% at the school level. Within each school, two classes were randomly sampled (class participation rate = 94.5%) and all students in these classes who were present asked to participate (student participation rate = 91.1%). In total, 4363 students participated across 222 classes in 100 schools.

In wave 2, 98% of all previous schools and 72.5% of all students at these schools participated again (N = 3614). We added an extra sample of students who were not part of the sampling frame, but nevertheless participated mainly for two reasons ($N_{students\_new}$= 2307). First, some respondents participated in the first wave even though the school had not been sampled then. This was, for example, because schools wanted to participate with more than the two sampled classes (for a detailed overview, see Kalter et al., 2013). Second, in wave 2 students were grouped according to their chosen track and classes therefore changed considerably between wave 1 and wave 2. One goal of the CILS project was to survey whole classes, which means that new students who were not officially part of the original sampling frame were also surveyed.

The response rate of wave 4 is 55.5% and wave 5 is 54.4%, both calculated as the ratio between the number of respondents who participated and the number of adolescents who had

been approached and did not refused participation before the start of wave 4 or 5, respectively. In both waves a mixed mode approach was used. In wave 4, approximately 69% completed an electronic questionnaire, 10% filled in a print questionnaire, and 21% responded by telephone. In wave 5, approximately 85% completed an electronic questionnaire, 1% filled in a print questionnaire and 14% responded by telephone.

In total, 5921 respondents participated in wave 2 ($N_{classes}$= 301), 1600 of whom fulfilled our sample requirement of having chosen a STEM track in secondary education. However, in order to obtain our final analytical sample, we excluded respondents who had not participated in wave 4 or wave 5 (n = 439) and who had not selected a field of study (n = 324; most of these students were still in secondary education). After the exclusion of missing values on all variables of interest (n = 93; 51 due to not having friends), our analytical sample comprised 744 students from 174 classes.

Operationalization

The *dependent variable* is categorical and measures individual STEM field choices in post-secondary education. It is based on the question "What is your field of study?"/ The original response categories were coded into the 3-digit International Standard Classification of Education (ISCED97; UNESCO, 2006). This was recoded into two categories: (1) *STEM field* or *non-STEM field* (0; see appendix D1 for a full overview of the coding of the dependent variable). Due to our interest in gender, we focused on STEM fields in which women are underrepresented (Diekman et al., 2010) and defined fields such as medicine as non-STEM fields.[1]

The main *independent variables* are *sex (girl = 1)*, showing whether the respondent is a girl (1) or a boy (0).

Traditional gender norms of friends indicates how traditional respondents' classroom friends are when it comes to male and female gender role behavior. The question "Who are your best friends in class?" was used to identify friends in the respondents' class, with respondents being allowed to name up to five friends. All respondents were asked about their gender norms and because complete classes participated in wave 2, we have the gender norms of the respondent's classroom friend group. Traditional gender role behavior was measured by the question "Who do you think should do the following tasks?". The tasks were taking care of the children, cooking, earning money, and cleaning the house. Response categories were "mostly the man," "mostly the woman," and "both about the same." For the more feminine tasks – taking care of the children, cooking and cleaning – we assigned a score of 2 to respondents who answered "mostly the woman," a score of 1 if they answered "both about the same," and a score of 0 if they answered "mostly the men." For the more masculine item earning money, we assigned a score of 0 to respondents who answered

[1] To ensure the robustness of our results, we ran all analyses again with biology, health, and medicine-related fields as a separate dependent category. This category included life sciences, biology, and biochemistry; health, medicine, dental studies, medical diagnostics and treatment technology, and pharmacy. Because there were too few girls in life sciences, biology, and biochemistry, we were not able to run analyses on biology-related fields as a separate category from health & medicine-related fields. In total, 106 adolescents (n_{boys} = 34; n_{girls} = 72) chose biology, health, and medicine-related fields. The effect of gender norms was less pronounced, but the results are similar to those reported in this chapter and did not alter our main conclusions. Neither friends' traditional gender norms nor the gender composition of the friend group affected the average likelihood of boys or girls choosing biology, health, and medicine-related fields.

"mostly the woman," a score of 1 if they answered "both about the same," and a score of 2 if they answered "mostly the man." A mean score was calculated (Cronbach's $\alpha = .70$) in which higher scores indicated more traditional gender norms. To analyze how traditional friends' gender norms were, we averaged the traditional gender norms score (the mean scale of all four items) of the respondents' friend group (not including their own gender norms).

Proportion of same-sex friends refers to the proportion of males in the boys' friend group and the proportion of females in the girls' friend group.

Controls

We controlled for *individual math achievement* as an important indicator for whether students choose STEM fields. Mathematics achievement refers to the respondent's math achievement as indicated by the math grade in his or her latest progress report ("What was your math grade in your latest progress report?") and can vary between 1 (low achievement) and 10 (high achievement). In addition, we also controlled for the *math achievement of friends*, reflecting how well the respondent's friend group in class does in mathematics. We did this by averaging the math achievement of respondents' best friends in class.

Traditional gender norms refers to the respondent's own traditional gender norms. We held this constant because we are interested in how a traditional gender normative environment affects STEM choices irrespective of respondent's own gender norms.

As the children of higher-educated families are more likely to make gender atypical field of study choices (Støren & Arnesen, 2007), we also controlled for the *highest educational level of parents*, which refers to the highest educational level attained by a couple (either by the father or the mother) or by one parent if the respondent comes from a single-parent household. In wave 1 (and also for students who entered the sample in wave 2), respondents were given a questionnaire for one of their parents to complete at home. If they did not respond, they were sent a reminder and ultimately contacted by phone if possible (response rate parents' questionnaire wave 1: 74.7%; response rate parents' questionnaire wave 2: 42.8%). The parents were asked about their and their partner's highest completed educational level: primary education (1), secondary education (2), vocational education and training (3), higher vocational education (4), or university (5). We added no education (0) when parents had not completed primary education. The children were asked a similar question in wave 2 ("What is the highest completed educational level of your biological mother/father?"). The response categories were primary education, secondary education, or university. We replaced parents' missing values if respondents indicated that they live with their biological parents (n = 219).

As the data contain an oversampling of respondents with a non-western immigrant background, we also controlled for *non-western immigrant background*. This variable indicates whether one of the adolescent's parents were (1) or were not (0) born in a non-western country.[2]

[2] 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.

Finally, to control for possible track and level differences within the STEM tracks in secondary school, we included a set of dummy variables: *science & health-general level; science, health & technology-general level; science & technology-general level* and *science & health-academic level; science, health & technology-academic level; science & technology-academic level.* These six dummy variables indicate whether students choose the science & health level, a combination of science & health and science & technology, or science & technology in the general or academic level, respectively. The reference category is students who choose technology in the vocational level; *technology-vocational level.* Table 5.1 shows the descriptive statistics of all variables in our analyses.

Selectivity of the sample

Two types of selectivity may occur in our sample. First, we only include students who have chosen a STEM track in secondary education. These students are likely to have chosen this track because they have an affinity with STEM-related subjects or the required skills (higher grades in science or mathematics). Because girls are less likely than boys to choose STEM trajectories (Van der Vleuten, Jaspers, Maas, & Van der Lippe, 2016), the girls in our sample may be especially motivated and achievement-driven. Additionally, if girls are outperforming boys in mathematics, they are also more likely to have a high-achieving friend group of girls, since adolescents often have same-sex friendships. This would lead to girls being more likely than boys to enter STEM fields after secondary education. However, two-sample t-tests showed no significant gender differences for either math achievement or for math achievement of the friend group.[3] We can therefore assume that the girls in our sample are not a more selective group (based on their own math achievement/math achievement of their friend group) than the boys in our sample.

Second, our sample may be selective due to panel attrition (dropouts) or non-response on the field of study variable. These adolescents may have somewhat different characteristics than students who are in our data and who have chosen a field of study. For example, the children of higher-educated parents may be more likely to continue their education (Sewell, 1971). Overall, 365 respondents dropped out of the survey in wave 4 or 5, while 293 respondents did participate in wave 4 or 5 but had not chosen a field of study (for example they were still in secondary education or they had started work). To test for this type of selectivity, all analyses were repeated using multinomial logit analyses with a categorical dependent variable if students are in our data (0), dropped out of our data (1), or did not choose a field of study but were in our data (2). We find evidence that students from higher-educated backgrounds, the general and academic level, girls and students with a western background are less likely to drop out. Girls and students on the academic level are less likely than boys or students on the general/vocational level to have already chosen a field of study, respectively. This means that our sample is selective on some characteristics and we should be careful about generalizing our results to the whole population. Especially the underrepresentation of boys in our data could that we either underestimate the effect of boys or that the remaining boys might be a specific group.

[3] We also ran two-sampled t-tests that test differences between boys and girls in math achievement and math achievement of the friend group split for different levels of secondary education (vocational, general, academic), which did not change our conclusions. Results are available on request.

Table 5.1 *Descriptive statistics of all the variables in our analyses for all respondents (N=744), and for boys (n = 444) and girls (n = 300) separately.*

	MEAN / *SD*			*MIN*			*MAX*		
	Total	Boys	Girls	Total	Boys	Girls	Total	Boys	Girls
Dependent variable									
Non-STEM fields	.60	.44	.83	0	0	0	1	1	1
STEM fields	.40	.56	.17	0	0	0	1	1	1
Independent variables									
Sex (girl = 1)	.40			0	0	0	1	1	1
Traditional gender norms of friends	1.33 (0.24)	1.40 (0.23)	1.23 (0.21)	.63	.63	.75	2	2	2
Proportion of same-sex friends	0.90 (0.22)	0.90 (0.22)	0.89 (0.22)	0	0	0	1	1	1
Controls									
Mathematics achievement	6.89 (1.34)	6.84 (1.39)	6.97 (1.27)	2	2	3	10	10	10
Math achievement of friends in class	6.75 (0.96)	6.72 (0.92)	6.79 (1.01)	3	3	3	10	9	10
Traditional gender norms	1.34 (0.34)	1.42 (0.35)	1.21 (0.29)	0.5	0.5	0.75	2	2	2
Highest educational level parents	3.37 (1.14)	3.33 (1.11)	3.43 (1.18)	0	0	0	5	5	5
Non-western immigrant background	0.14	0.11	0.18	0	0	0	1	1	1
Technology-vocational level	.29	.43	.09	0	0	0	1	1	1
Science & Health-general level	.19	.11	.30	0	0	0	1	1	1
Science & Health & technology-general level	.04	.03	.05	0	0	0	1	1	1
Science & Technology-general level	.10	.14	.04	0	0	0	1	1	1
Science & Health-academic level	.16	.09	.26	0	0	0	1	1	1
Science & Health & technology-academic level	.10	.07	.14	0	0	0	1	1	1
Science & Technology-academic level	.12	.12	.12	0	0	0	1	1	1

Source: Wave 2 of Children of Immigrants Longitudinal Survey in Four European Countries and wave 4 and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations.
Note: For categorical variables, proportions are given.

5.4 Analyses

Given the binary nature of our dependent variable, we performed logit regression analyses in STATA13 to test our hypotheses. We clustered standard errors at the class level (wave 2) to take into account the dependency of our data (students are nested within classes; $n = 174$).

Four models that include control variables were estimated and results are shown in table 5.2. Model 1 tests whether girls are less likely than boys to choose a STEM field after secondary education (H1). Model 2 includes an interaction between the variable *sex (girl = 1)* and *friends' traditional gender norms* and tests whether having friends with more traditional gender norms increases the likelihood of boys choosing STEM fields and decreases the likelihood of girls choosing STEM fields (H2). Model 3 sheds light on how same-sex friends affect gender differences in STEM fields (H3A & H3B). To test whether the proportion of same-sex friends increases (H3A) or decreases (H3B) the likelihood of girls choosing STEM fields and whether the proportion of same-sex friends decreases (H3A) or increases (H3B) the likelihood of boys choosing STEM fields, we included the interaction between the variable *sex (girl = 1)* and *proportion of same-sex friends*. Finally, model 4 is the full model. Table 5.2 shows the results in terms of log-odds. In order to facilitate interpretation, we calculate predictive margins and average marginal effects (AME). Predictive margins give the average chance that boys and girls choose STEM fields given a value of an independent variable (e.g., friends' gender norms and gender composition). Multiplied by 100 this is the average probability in percentages. AME give the average change in the probability of choosing STEM fields by one unit change in an explanatory variable. Multiplied by 100 this is the average change in percentages. As we will see, predictive probabilities and AME's provide the same information, but AME's allow us to test whether differences between boys and girls are significant. In order to substantively interpret the interaction effects of sex with friends' traditional gender norms and sex with the gender composition of the friend group, we use plots (plots are the correct way to interpret interactions as AME's for interactions make no sense; Williams, 2012). Lastly, table 5.3 shows the analyses separately for boys (model 1 to 3) and girls (model 4 to 6). These models present AME's.

In order to assess the models, we performed Wald-tests to see whether the variables contribute significantly to the model, and used generalized Hosmer and Lemeshow goodness-of-fit measures for the model fit (Fagerland & Hosmer, 2012). In this test, the observations are ordered by expected probabilities and subsequently grouped into 10 groups. A Chi^2 then calculates the difference between the observed and predicted values and a non-significant p-value means that the observed values and the model-predicted values do not differ from each other, indicating a good fit.

5.5 Results

Bivariate findings

Figure 5.1 shows the percentage of respondents, girls and boys in our sample who enter STEM or non-STEM fields after secondary education. We see that girls choose for more non-STEM fields than STEM fields, whereas for boys this is the opposite. Boys are significantly more likely than girls to enter STEM fields, $\chi^2(1, N = 744) = 116.90$, $p < .001$. This suggests that even though the girls in our sample have chosen a STEM-related track in secondary education, most of them do not continue in STEM after secondary education.

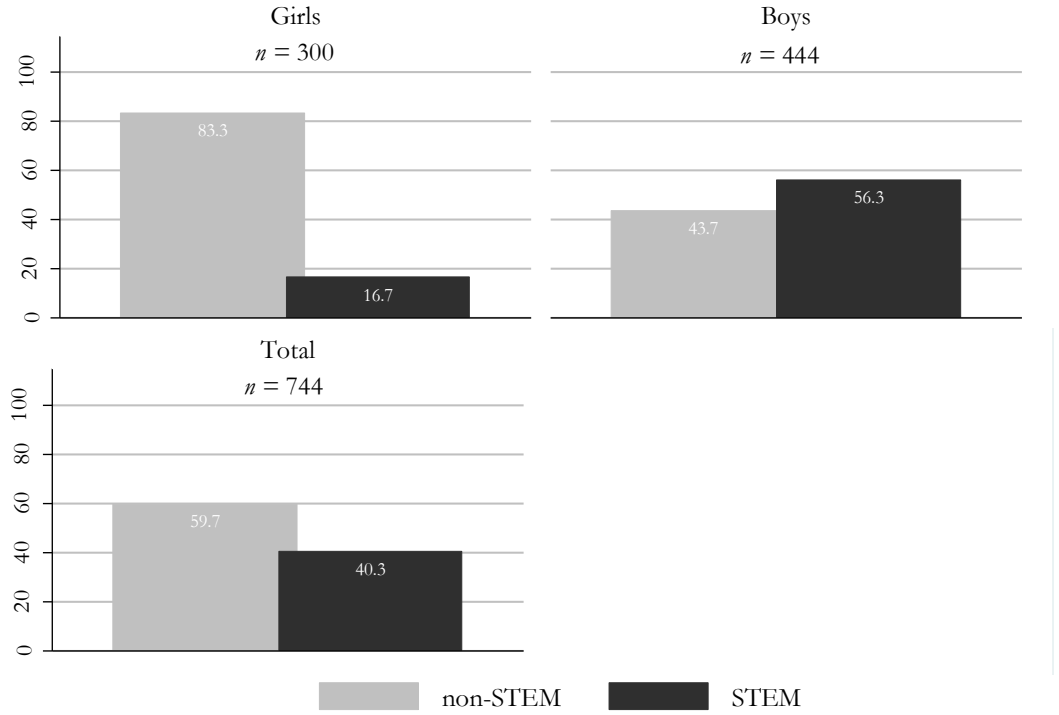

Figure 5.1 Percentage of adolescents who choose STEM or non-STEM fields after secondary education (girls, boys and all respondents in sample).

Figure 5.2 shows the percentage of adolescents who enter STEM and non-STEM fields after secondary education, grouped into girls (top of figure) and boys (bottom of figure) who have friends with less traditional gender norms (left side of figure; friends' traditional gender norms <= 1.25) and more traditional gender norms (right side of figure; friends' traditional gender norms > 1.25).[4] This figure shows that of all girls with less traditional friends, 80.2% enter non-STEM fields and 19.8% STEM fields. Of all girls with more traditional friends, 89.3% enter non-STEM fields and 10.7% STEM fields. The percentage of girls who enter STEM fields is significantly higher when they have less traditional friends than when they have friends with more traditional gender norms ($\chi^2(1, n = 300) = 4.05, p < .05$). We see a similar trend for boys, but less pronounced and non-significant. Of all boys with less traditional friends, 45.3% enter non-STEM fields and 54.7% STEM fields, whereas of the boys with more traditional friends, 42.9% enter non-STEM fields and 57.1% STEM fields. The likelihood of boys with less traditional friends entering STEM fields does not differ significantly from that of boys with more traditional friends ($\chi^2(1, n = 444) = 0.25, p = .62$).

[4] The cut-off point of 1.25 was chosen because otherwise the group of students who have friends with less traditional gender norms would be very small. For example, with a cut-off point of 1, we would have 99 respondents whose friends have less traditional gender norms ($n_{boys} = 30$; $n_{girls} = 69$).

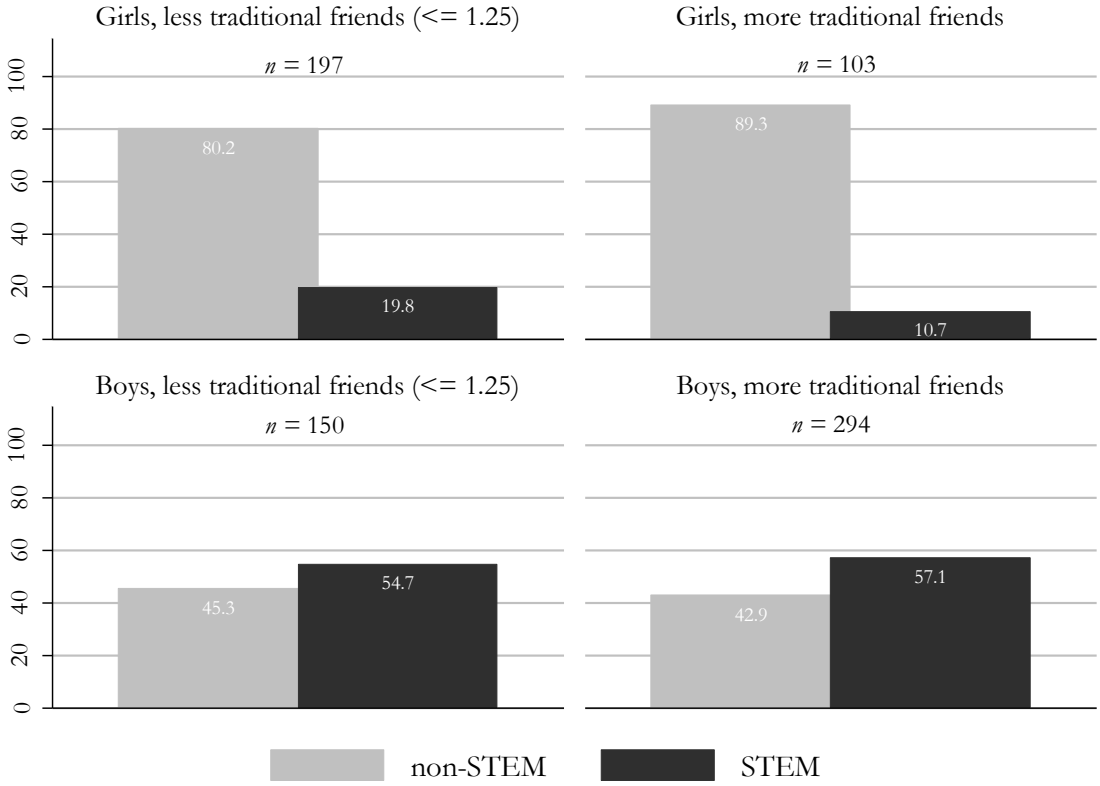

Figure 5.2 Percentage of adolescents who enter STEM/non-STEM fields after secondary education, grouped into girls (top of figure) and boys (bottom of figure) who have friends with less traditional gender norms (left side of figure) and more traditional gender norms (right side of figure).

Lastly, figure 5.3 shows the percentage of girls (top of figure) and boys (bottom of figure) who choose STEM or non-STEM fields and who have only same-sex friends (left side of figure) or at least one opposite-sex friend (right side of figure). This figure shows of all girls with only same-sex friends, 82.3% enter non-STEM fields and 17.7% STEM fields. Of all girls with at least one opposite-sex friend, 86.5% enter non-STEM fields and 13.5% STEM fields. Girls who have more same-sex friends do not differ from girls who have at least one opposite-sex friend when it comes to choosing a STEM/non-STEM field, $\chi^2(1, n = 300) = 0.70, p = .40$). Of all boys with only same-sex friends, 40.4% enter non-STEM fields and 59.7% STEM fields. Of all boys with at least one opposite-sex friend, 54.9% enter non-STEM fields and 45.1% STEM fields. Boys who have more same-sex friends are more likely to enter STEM fields than boys who have (at least) one female friend ($\chi^2(1, n = 444) = 6.76, p < .01$).

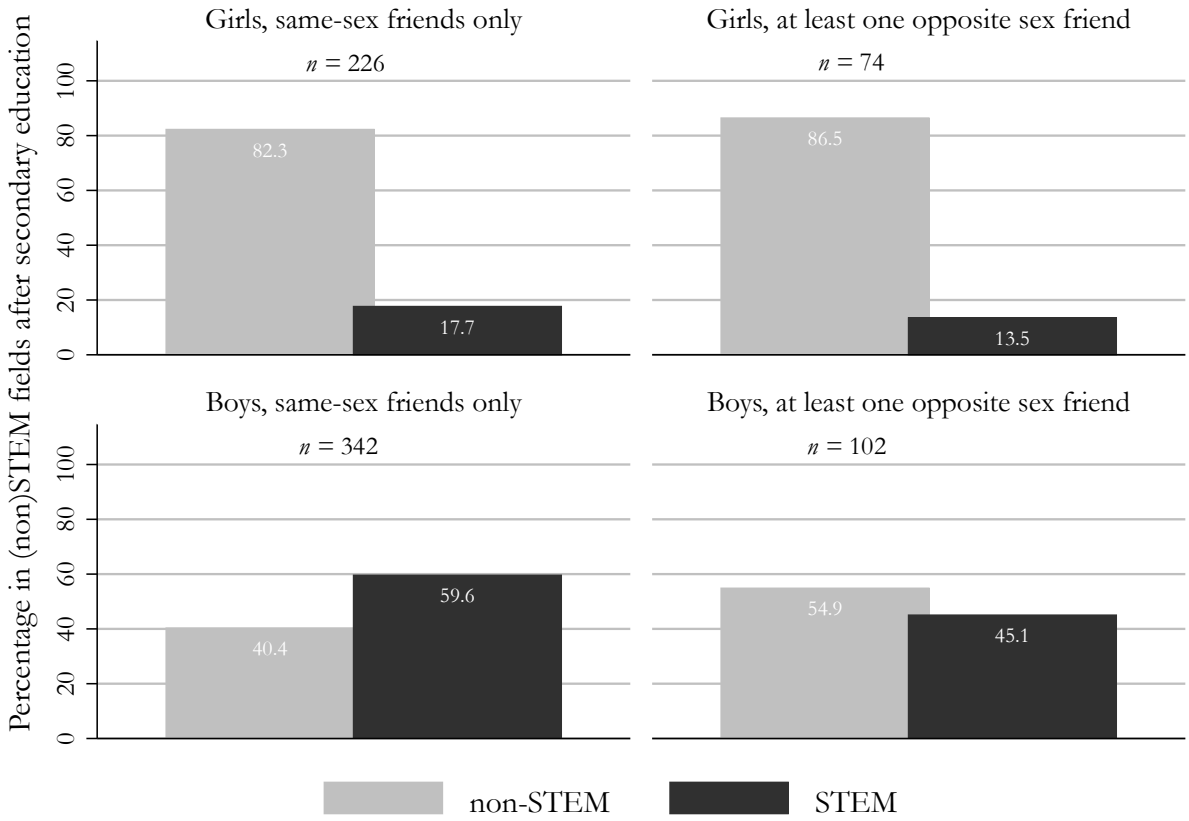

Figure 5.3 Percentage of adolescents who enter STEM/non-STEM fields after secondary education, grouped into girls (top of figure) and boys (bottom of figure) who have only same-sex friends (left side of figure) and at least one opposite-sex friend (right side of figure).

Multivariate findings

Model 1 in table 5.2 shows that girls are less likely than boys to choose STEM fields. Calculated in average marginal effects, girls are on average 33% less likely than boys to choose STEM. This confirms our first hypothesis that girls are less likely than boys to choose a STEM field after secondary education (H1). Model 2 examines whether friends' traditional gender norms lead to gender differences in STEM fields. The two added variables make a significant contribution to the model (Wald $\chi(2)^2 = 9.64$; $p < 0.01$). The main effect of the variable friends' traditional gender norms indicates that boys are not affected by friends' traditional gender norms and the interaction shows that an increase in friends' traditional gender norms is associated with a lower likelihood of girls choosing STEM fields at an alpha of .10. When we look at the analyses for boys and girls separately, in table 5.3, we come to the conclusion that the effect of friends' traditional gender norms is significant for girls, but not for boys. Model 1 and 3 in table 5.3 shows that for every point increase in friends' traditional gender norms, the average likelihood of girls choosing STEM fields decreases by 31%. The effect of friends' traditional gender norms does not reach significance for boys (model 4 & 6). Overall, we find support for hypothesis 2 for girls, but not for boys.

Model 2 in table 5.2 also shows the main effect of the variable *sex (girl = 1)* becomes insignificant when we include friends' traditional norms and the interaction with gender. This means that if all friends were completely non-traditional (friends' traditional gender norms = 0), there would be no gender difference in the respondents' likelihood of choosing STEM fields. Table

5.1 shows that this is an unrealistic situation, since the minimum value on friends' traditional norms is 0.63 (on a scale from 0 - 2). Nevertheless, friends' traditional gender norms explain gender differences in STEM fields to some extent and is associated with the likelihood of girls choosing STEM fields.

Model 3 in table 5.2 tests the effect of gender composition on the likelihood of adolescents entering STEM fields. The two variables make a significant contribution to the model (Wald $\chi(2)^2 = 7.87$; $p < 0.05$). The results show that having a higher percentage of male friends is associated with an increase in the likelihood of boys choosing STEM fields, whereas having a higher percentage of females friends seems not to affect girls' likelihood of choosing STEM fields. When we look at the analyses for boys and girls separately, in table 5.3, we also conclude that the proportion of same-sex friends is not associated with STEM choices for girls, but is associated with boys' STEM choices. Model 6 shows that for boys, going from an all-female environment to an all-male environment increases the average likelihood of boys entering STEM fields by 34%. This result partly supports H3A.

Model 3 in table 5.2 also shows that the main effect of gender is no longer significant. In other words, among students with exclusively opposite-sex friends, gender makes no difference to the likelihood of their choosing STEM fields.

Model 4 includes all the variables. Both gender norms and gender composition for boys and girls make a significant contribution to the model (Wald $\chi(4)^2 = 20.50$; $p < 0.001$). Having more male friends is associated with an increase in the likelihood of boys choosing STEM fields, and having more female friend is associated with a decrease in likelihood of girls choosing STEM fields. The effect of friends' traditional gender norms does not reach significance for boys or girls.

Table 5.2 also shows that a higher math achievement is associated with an increase in likelihood of choosing STEM fields. Table 5.3 shows that a higher math achievement is related to more STEM choices for boys, but not for girls. Furthermore, both tables show that compared to students on the Technology-vocational level, students on the Science & Health-general level and Science & Health-academic level are less likely to enter STEM fields, although for boys this effect is weaker when they attend the academic level (table 5.3). Table 5.3 additionally shows that girls on the Science & Health & Technology–academic level are less likely than students on the Technology-vocational level to continue in STEM fields. For all models estimated in table 5.2 or 5.3, the goodness-of-fit tests indicate that the observed and predicted models do not differ significantly, indicating a good model fit.

Table 5.2 *Results of logit regression models that test the effect of friends' gender norms and the gender composition of the friend group on choosing STEM fields (N = 744; standard errors clustered by class: N = 174 classes).*

Independent variables	Model 1	Model 2	Model 3	Model 4
Sex (girl = 1)	-1.66***	0.05	-0.30	1.75
	(0.21)	(1.07)	(0.87)	(1.38)
Traditional gender norms of friends		-0.62		-0.93+
		(0.46)		(0.48)
Traditional gender norms of friends × sex (girl = 1)		-1.48+		-1.33
		(0.85)		(0.88)
Proportion of same-sex friends			1.34**	1.55**
			(0.48)	(0.50)
Proportion of same-sex friends × sex (girl = 1)			-1.53	-2.18*
			(0.96)	(0.99)
Controls				
Mathematics achievement	0.19*	0.18*	0.19*	0.18*
	(0.08)	(0.08)	(0.08)	(0.08)
Math achievement of friends	-0.02	0.00	-0.03	0.00
	(0.09)	(0.09)	(0.09)	(0.09)
Traditional gender norms	-0.04	0.04	-0.04	0.06
	(0.23)	(0.24)	(0.24)	(0.24)
Highest educational level parents	-0.08	-0.09	-0.08	-0.09
	(0.08)	(0.08)	(0.08)	(0.09)
Non-western immigrant background	0.03	0.08	0.07	0.12
	(0.24)	(0.25)	(0.24)	(0.26)
Science & Health-general level	-1.15***	-1.19***	-1.11***	-1.17***
	(0.30)	(0.31)	(0.31)	(0.31)
Science & Health & Technology-general level	0.80+	0.79+	0.90*	0.89+
	(0.43)	(0.46)	(0.44)	(0.46)
Science & Technology-General level	0.02	0.07	0.09	0.15
	(0.30)	(0.32)	(0.30)	(0.32)
Science & Health-academic level	-0.99**	-1.02**	-0.91*	-0.92*
	(0.36)	(0.36)	(0.36)	(0.36)
Science & Health & Technology-academic level	-0.35	-0.37	-0.34	-0.37
	(0.35)	(0.36)	(0.35)	(0.36)
Science & Technology-academic level	0.03	-0.04	0.09	0.03
	(0.29)	(0.29)	(0.28)	(0.28)
Constant	-0.35	0.36	-1.60+	-0.69
	(0.82)	(1.03)	(0.93)	(1.07)
Model fit				
Hosmer-Lemeshow chi^2	1.74	2.27	1.86	5.75
df	8	8	8	8
P-value	0.99	0.97	0.99	0.68

Source: Wave 2 of Children of Immigrants Longitudinal Survey in Four European Countries and wave 4 and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations. $^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Table 5.3 *Results of logit regression models that test the effect of friends' gender norms and the gender composition of the friend group on choosing STEM fields for girls (n = 300) and boys (n = 444) separately (N = 744; standard errors clustered by class: N = 174 classes).*

	Girls			Boys		
Independent variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Traditional gender norms of friends	-0.31**		-0.31**	-0.13		-0.20+
	(0.10)		(0.10)	(0.10)		(0.11)
Proportion of same-sex friends		-0.01	-0.06		0.30**	0.34**
		(0.10)	(0.11)		(0.11)	(0.11)
Controls						
Mathematics achievement	0.01	0.02	0.01	0.04*	0.05*	0.04*
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Math achievement of friends	0.00	-0.00	0.00	-0.01	-0.01	-0.00
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Traditional gender norms	-0.00	-0.01	-0.01	0.00	-0.01	0.01
	(0.07)	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)
Highest educational level parents	0.01	0.02	0.01	-0.04	-0.04+	-0.04+
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)
Immigrant background	0.08	0.06	0.08	-0.06	-0.04	-0.05
	(0.05)	(0.05)	(0.05)	(0.07)	(0.07)	(0.07)
Science & health - general level	-0.29**	-0.28**	-0.29**	-0.24**	-0.22**	-0.23**
	(0.10)	(0.10)	(0.10)	(0.08)	(0.08)	(0.08)
Science & Health-general level	0.01	0.03	0.01	0.21+	0.24*	0.24*
	(0.16)	(0.16)	(0.16)	(0.12)	(0.11)	(0.11)
Science & Health & Technology-general level	-0.01	-0.05	-0.01	0.02	0.03	0.04
	(0.17)	(0.15)	(0.17)	(0.08)	(0.07)	(0.08)
Science & Technology-General level	-0.29**	-0.26*	-0.28**	-0.20*	-0.17+	-0.16
	(0.11)	(0.11)	(0.11)	(0.10)	(0.10)	(0.10)
Science & Health-academic level	-0.25*	-0.23*	-0.24*	0.01	0.02	0.00
	(0.11)	(0.12)	(0.11)	(0.10)	(0.10)	(0.10)
Science & Health & Technology-academic level	-0.17	-0.12	-0.16	0.04	0.05	0.05
	(0.12)	(0.13)	(0.12)	(0.08)	(0.08)	(0.08)
Model fit						
Hosmer-Lemeshow chi^2	8.36	3.77	6.72	5.39	7.79	3.57
df	8	8	8	8	8	8
P-value	.40	.88	.57	0.71	0.45	0.89

Source: Wave 2 of Children of Immigrants Longitudinal Survey in Four European Countries and wave 4 and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations. $^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Figure 5.4a and figure 5.4b shows the predictive margins (5.4a) for boys and girls and average marginal effects (5.4b) for girls for different values of friends' traditional gender ideology (plots are based on model 4 in table 5.2). Figure 5.4a shows that the average probability of choosing STEM fields for boys whose friends have a less traditional gender ideology (at value 0.63) is .68 (or 68%), whereas it is .45 (45%) for girls. This probability declines for boys when their friends become more traditional, but much more for girls. When boys and girls have friends who have a very traditional gender ideology (value 2) we see that the average probability of choosing STEM fields decreased to .54 (54%) for boys and to .17 (17%) for girls. Figure 5.4b shows the same but then in AME's. The AME's became significant at the value .75 of friends' traditional gender norms, meaning that from that point the average chance of girls choosing STEM fields significantly differs from the average chance of boys choosing STEM fields. Compared to boys, girls are on average 23% less likely to choose STEM fields when their friend group is less traditional (value of 0.63) and 37% less likely to choose STEM fields when their friends have a more traditional gender ideology (value of 2).

Figure 5.4c shows that the average probability of choosing STEM fields for boys and girls who have no same-sex friends is .25 (or 25%). In line with our conclusion from model 3 in table 5.2, among adolescents with exclusively opposite-sex friends, there are no gender differences in the likelihood of choosing STEM fields. Figure 5.4c shows that having more same-sex friends increases the average probability of choosing STEM fields for boys, whereas it decreases the average probability of choosing STEM fields for girls. For adolescents with only same-sex friends (value 1) the average probability of choosing STEM fields increased to .54 (54%) for boys and decreased to .17 (17%) for girls. In figure 5.4d (note that the y-values are different than in figure 5.4b), girls do not significantly differ from boys in their average chance of choosing STEM fields when they have only opposite sex friends. The AME's became significant when half (or more) of the friend group is of the same-sex (value 0.5). Girls are significantly less likely than boys to choose STEM fields when half or more than half of their friend group is of the same sex. When boys and girls have only same-sex friends (value 1) girls are on average 37% less likely than boys to choose STEM fields. However, this effect results mainly from the fact that the average chance of boys choosing STEM fields increases and not from a change in the effect of same-sex friends on the average chance that girls choose STEM fields.

Taken together, our results show that having friends with more traditional gender norms is associated with a lower likelihood of girls choosing STEM fields (in accordance with H2), whereas more same-sex friends is associated with an increase in likelihood of boys choosing STEM fields (in accordance with H3A).

Previous research shows that, besides friends, the classroom *context* can also play an important role in gender differences in STEM fields (Dryler, 1999). To make sure that our findings can be attributed to classroom friends and not classroom characteristics, we ran all analyses in table 5.2 and 5.3 again and included the following classroom context variables: traditional gender norms of the classroom (excluding own gender norms and the gender norms of the friend group); proportion of females in the classroom (excluding own sex and sex of friends); and average classroom math achievement (excluding own math achievement and math achievement of friend group). We also interacted these characteristics with sex of respondent to see if the influence was

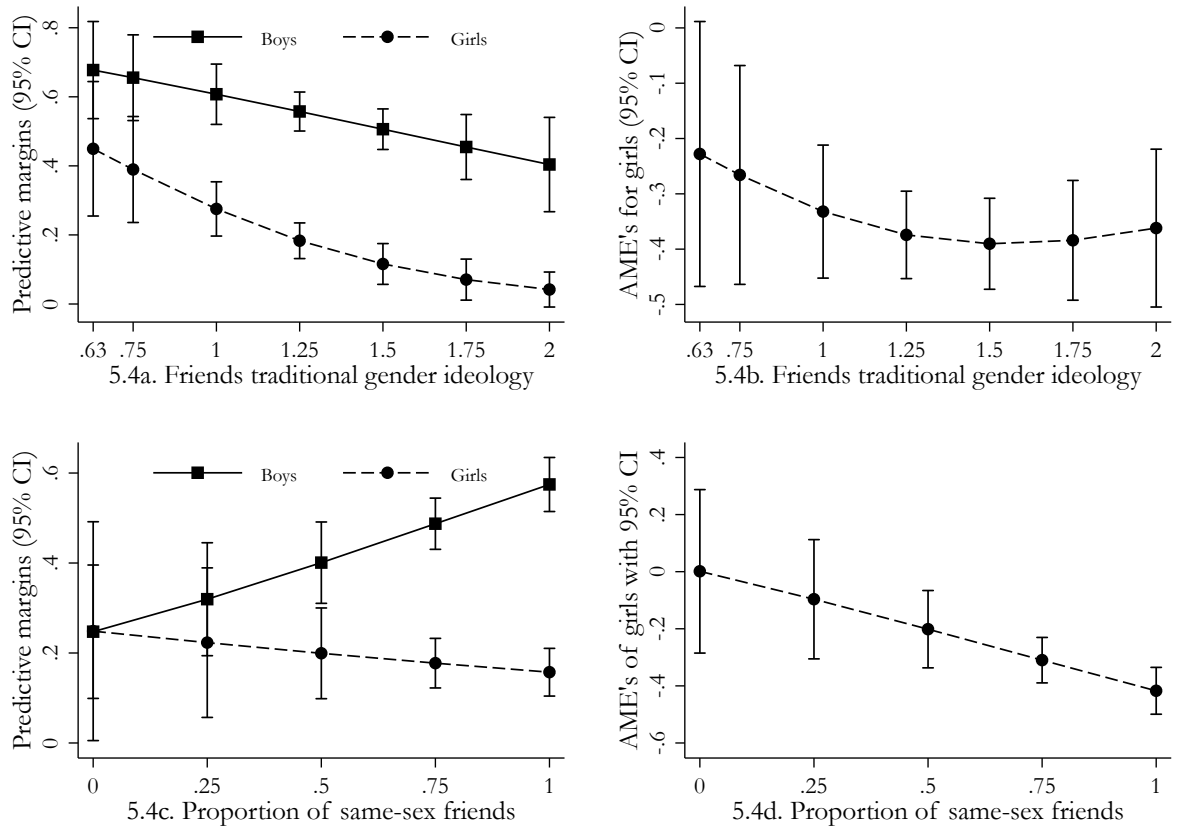

Figure 5.4 Predictive margins and average marginal effects for different values of friends' traditional gender norms (5a & 5b) and different values of same-sex friends (figure 5c & 5d)

different for boys and girls. Overall, the results did not differ much from the ones reported in this paper. The classroom context did not have any significant effects.S These extra analyses highlight the importance of classroom friends (i.e. their gender normativity and gender composition) for adolescents' STEM choices.

5.6 Conclusion and discussion

This study examined the role of classroom friends in boys' and girls' STEM choices. We tested if the gender normativity and gender composition of an adolescent's friend group was associated with gender differences in STEM fields. We focused on students in the STEM pipeline – i.e. boys and girls who have already chosen a STEM-related track in secondary education – to gain a better understanding of possible causes of gender specific STEM dropout when adolescents choose a field of study. Using three waves of the Children of Immigrants Longitudinal Survey, we analyzed 744 students using logistic regression analyses.

Despite various government efforts to open STEM fields to girls, we still find a substantial gender gap in STEM choices in the Netherlands. Girls are on average 33% less likely to choose STEM fields than boys. To explain this gender gap, we examined the role of the gender normativity and gender composition of an adolescent's friend group and have concluded that gender normativity is more important for girls, whereas gender composition is more important for boys.

We found that girls are less likely to enter STEM fields when they have friends with more traditional gender norms, irrespective of their own gender norms. This is in line with research showing that STEM fields are incongruent with female gender role behavior, which pushes women away (Charles & Bradley, 2009; Charles et al., 2014; Legewie & DiPrete, 2014; Morgan et al., 2013). Our results highlight that friends' traditional gender norms identifying "appropriate" male or female behavior can be persuasive and is associated with girls dropping out of the STEM pipeline after secondary education. The fact that girls, but not boys, are influenced by their friends' traditional gender norms agrees with research showing that girls are more responsive to social norms in their networks (Frank et al., 2008). Girls who choose a field of study based on what is socially desirable are more likely to be missing out on the professional status and high-earning opportunities that STEM careers offer. Moreover, society may be missing out on talented girls doing what they do best.

We can additionally conclude that boys are more likely to choose STEM fields when they have a higher percentage of boys in their friend group, whereas having friends with traditional gender norms is much less important for their STEM choices. Although studies on the gender composition of the friend group have suggested that individuals are more likely to comply with gender-typed norms in same-sex groups than in mixed-sex groups (Hilliard & Liben, 2010; Martin & Fabes, 2001; Schneeweis & Zweimüller, 2012) or that boys are penalized more for not conforming to gender-typed norms (Carter & McCloskey, 1984; Fagot, 1977; Simpson, 2005), such norms appear to be less relevant for boys. In other words, having more male friends is associated with gender stereotypical behavior for boys – in this case a higher likelihood of entering STEM fields – but this is not because their friends' gender norms pressure them into gender-conforming behavior. For boys, other plausible explanations for gendered network effects are more useful, for example that same-sex friends are more likely to share gender-typed interests and activities (Martin et al., 2013). As STEM fields are considered to coincide more with male-typical interests, boys who have more same-sex friends are more likely to engage in and share STEM-related interests. Having more same-sex friends may therefore increase the likelihood of boys choosing STEM fields.

The findings of this study should be viewed in the context of it limitation. Like most studies on peer influence, we cannot know for certain that the effects of the environment are not (in part) the result of individuals choosing friends based on certain characteristics, often those that they share in common (Brechwald & Prinstein, 2011; Mouw, 2006). Unfortunately our data were not suited for social network analyses, but future research on the influence of friends on gender differences in STEM fields could benefit from advanced statistical tools that disentangle the processes of selection and influence within friend circles (Steglich et al., 2010). Moreover, we should be cautious about generalizing these our results on peer or classroom effects to other countries or educational systems. The Netherlands has a distinctive educational system in which adolescents already choose a field of study-related track in secondary education and make field of study choices after secondary education at all levels. Even though this makes the Netherlands a unique case study, it would be interesting for future research to explore how gender norms and gender composition of classroom friends affect STEM choices in other educational systems (like college major choices at tertiary education in the USA). Furthermore, although classroom friends are important for shaping STEM choices, future research could also investigate the effect of friends

in general (i.e., including friends outside the classroom), since adolescents are likely to have friends and peer groups outside the school and classroom as well.

Despite these limitations, we can conclude that adolescents' friends in secondary education play an important role in shaping their STEM choices. We have shown that friends who have more traditional gender normative ideas push girls out of the STEM pipeline, whereas same-sex friends keep boys in the STEM pipeline. Our research suggests that STEM fields are still thought of as an "inappropriate" choice for girls in school environments. We might reduce the leakage of girls from the STEM pipeline by tackling norms of what is "appropriate" male and female gender role behavior.

Appendices

Appendix A

Table A.1 *Coding of feminine subject preferences. Favorite subject mentioned by respondent, their coding into ISCED fields for higher education, and the percentage of women in those fields in 2012 based on national statistics in the Netherlands.*

Favorite subject mentioned	**ISCED code**	**ISCED field**	**% women**
Educational science	1	Educational science	72.2459
Arts	2	Linguistics, History, Arts	54.2493
Natural science	40	Natural science	32.9621
Information and communication technology	48	Information and communication technology	13.6562
Music	212	Performing arts	46.2169
Drama	212	Performing arts	46.2169
Religion	221	Religion general	53.9326
Dutch	223	Dutch general	78.4578
Philosophy	226	Philosophy general	37.3758
Social science/sociology	312	Sociology, Cultural Sciences	61.1502
Economics	314	Economics general	33.2529
Physics	441	Physics	13.4770
Chemistry	442	Chemistry general	30.6466
Geography	443	Geography	35.2685
Math	461	Math general	28.6881
Technics	520	Technics general	18.4185
Physical education	813	Sports	30.7312
Greek	22203	Classical languages	60.9610
Latin	22203	Classical languages	60.9610
English	22206	English	72.5510
French	22209	French	81.2298
German	22212	German	72.5424
Spanish	22215	Spanish	79.1080
Arabic	22221	Non-western languages and cultures	62.4161
Chinese	22221	Non-western languages and cultures	62.4161
History	22503	History	36.7327
Biology	42103	Biology	52.2762

Source: Percentages were derived from Statistics Netherlands (2011, 2012).

Table A.2 *Unstandardized regression effects of gender ideology on competence beliefs, occupational values and subject preferences for boys (n = 468) and girls (n = 594).*

	Boys		Girls	
Effect of gender ideology on:	*B*	*SE*	*B*	*SE*
Competence beliefs				
Verbal	0.02	0.09	-0.18**	0.07
Mathematical	0.06	0.15	0.17	0.15
Occupational values				
Helping	-0.26**	0.09	0.14	0.09
Income	0.20*	0.09	-0.05	0.08
Feminine subject preferences	-3.68*	1.65	2.02	1.71

Source: Wave 1 and wave 2 of Children of Immigrants Longitudinal Survey in Four European Countries.
$^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Table A.3 *Average marginal effects (×100) of competence beliefs, occupational values and subject preferences on educational track choice boys (n = 468) and girls (n = 594).*

	Science & Technology				Economics & Society				Science & Health				Culture & Society			
	Boys		Girls		Boys		Girls		Boys		Girls		Boys		Girls	
Effect of gender ideology on:	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Competence beliefs																
Verbal	-6.40*	2.91	-6.60**	2.12	6.24+	3.44	2.85	3.07	0.64	2.73	-2.45	2.80	-0.48	1.85	6.20*	2.43
Mathematical	14.30***	2.21	12.31***	1.63	-8.67***	2.35	-1.00	1.96	-2.76	1.89	-1.27	1.74	-2.86*	1.45	-10.04***	1.46
Occupational values																
Helping	-0.55	2.81	-1.49	2.46	-5.72+	3.17	-8.38*	3.33	6.35*	2.59	4.47	3.07	-0.08	1.13	5.41*	2.45
Income	-2.93	3.80	-1.92	2.76	5.51	4.32	9.99*	3.90	-2.43	3.57	-6.21+	3.40	-0.16	1.45	-1.86	3.20
Feminine subject preferences	-0.39*	0.16	-0.05	0.09	-0.01	0.17	0.29*	0.12	0.27*	0.13	-0.23*	0.12	0.12*	0.06	-0.01	0.09

Source: Wave 1 and wave 2 of Children of Immigrants Longitudinal Survey in Four European Countries. $^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$

Table A.4 *Indirect average marginal effects of gender ideology on educational track choice via competence beliefs, occupational values and subject preferences boys (n = 468) and girls (n = 594).*

	Science & Technology				Economics & Society				Science & Health				Culture & Society			
	Boys		Girls		Boys		Girls		Boys		Girls		Boys		Girls	
Mediators	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Competence beliefs																
Verbal	-0.10	0.62	1.17	0.79	0.10	0.66	-0.51	0.68	0.01	0.26	0.43	0.61	-0.01	0.18	-1.10	0.79
Mathematical	0.84	1.74	2.03	1.64	-0.51	1.03	-0.17	0.44	-0.16	0.42	-0.21	0.40	-0.17	0.43	-1.66	1.33
Occupational values																
Helping	0.14	0.77	-0.20	0.39	1.48	1.05	-1.13	0.83	-1.65+	0.98	0.60	0.59	0.02	0.31	0.73	0.55
Income	-0.59	0.84	0.10	0.30	1.12	1.06	-0.53	0.77	-0.49	0.80	0.33	0.51	-0.03	0.31	0.10	0.30
Feminine subject preferences	1.43	0.97	-0.11	0.29	0.02	0.66	0.59	0.75	-0.99	0.65	-0.47	0.61	-0.46	0.37	-0.01	0.29

Source: Wave 1 and wave 2 of Children of Immigrants Longitudinal Survey in Four European Countries. $^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Table A.5 *Direct average marginal effects (x100) of gender ideology and control variables on educational track choice boys (n = 468) and girls (n = 594).*

	Science & Technology				Economics & Society				Science & Health				Culture & Society			
	Boys		Girls		Boys		Girls		Boys		Girls		Boys		Girls	
	B	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Traditional gender ideology	-8.48	5.76	-0.15	4.55	7.49	6.90	7.14	6.04	5.66	4.83	-0.54	5.57	-4.67	3.57	-6.45	4.61
Cognitive ability	1.59*	0.79	-0.09	0.47	-2.22**	0.74	-0.37	0.75	0.88	0.61	0.85	0.70	-0.26	0.31	-0.39	0.61
Verbal ability	1.04^{+}	0.60	1.14*	0.46	-0.77	0.68	-0.97	0.59	-0.05	0.56	0.31	0.54	-0.22	0.27	-0.48	0.46
Highest occupational status parents	-0.08	0.13	-0.01	0.11	0.01	0.15	-0.10	0.13	0.21^{+}	0.13	0.05	0.13	0.14*	0.06	0.05	0.10
Highest educational level parents	2.49	2.02	3.00^{+}	1.68	-2.87	2.39	0.90	2.19	-1.15	1.90	-1.54	1.98	1.53	1.14	-2.35	1.65
Intact family	14.55*	6.22	-5.40	3.34	-21.12**	6.85	9.05^{+}	5.46	6.73	6.08	1.12	4.68	-0.16	4.62	-4.77	4.04
Immigrant	6.61	5.20	8.32*	3.61	-8.54	5.65	-10.23*	5.14	3.49	4.60	2.17	4.55	-1.57	2.56	-0.26	4.05
Academic level	14.14***	4.11	7.72*	3.08	-14.94***	4.62	0.09	4.41	2.37	3.53	-5.18	3.96	-1.57	2.77	-2.63	3.31

Source: Wave 1 and wave 2 of Children of Immigrants Longitudinal Survey in Four European Countries. $^{+}p < 0.10$; $^{*}p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$.

Appendix B

Table B.1 *Coding of ISCED fields into masculine or feminine fields of study separately for secondary vocational education and higher vocational education & university. The percentage of males and females in ISCED fields in 2013/2014 or 2014/2015 based on national statistics in the Netherlands.*

Secondary vocational education					
ISCED FIELD	**ISCED code**	**2013/2014 % females**	**2013/2014 % males**	**2014/2015 % females**	**2014/2015 % males**
Education	1	79.894	20.106	78.886	21.114
Teacher training and education science	14	79.894	20.106	78.886	21.114
Teacher training and education science	140	77.124	22.876	91.228	8.772
Training for teachers at basic levels	144	79.936	20.064	78.814	21.187
Humanities and arts	2	47.657	52.343	48.596	51.404
Arts	21	47.657	52.343	48.596	51.404
Music and performing arts	212	49.717	50.283	51.948	48.052
Audio-visual techniques and media production	213	36.636	63.364	37.680	62.320
Design	214	84.677	15.323	85.215	14.785
Craft skills	215	23.529	76.471	23.684	76.316
Social sciences, business and law	3	49.280	50.720	49.137	50.864
Social and behavioral science	31	53.144	46.856	59.464	40.536
Social and behavioral science	310	53.144	46.856	59.464	40.536
Journalism and information	32	78.378	21.622	72.881	27.119
Library, information, archive	322	78.378	21.622	72.881	27.119
Business and administration	34	48.611	51.389	48.376	51.624
Wholesale and retail sales	341	43.075	56.925	42.351	57.649
Marketing and advertising	342	31.959	68.041	30.885	69.115
Finance, banking, insurance	343	40.932	59.068	40.948	59.052
Accounting and taxation	344	37.972	62.028	37.325	62.675
Management and administration	345	75.224	24.776	76.023	23.978
Secretarial and office work	346	86.556	13.445	88.531	11.469
Law	38	65.130	34.870	64.866	35.134
Law	380	65.130	34.870	64.866	35.134
Science, mathematics and computing	4	4.055	95.945	4.455	95.545
Life science	42	48.983	51.017	50.584	49.416
Life science	420	48.983	51.017	50.584	49.416
Computing	48	2.536	97.464	2.743	97.257
Computer science	481	2.536	97.464	2.743	97.257
Engineering, manufacturing and construction	5	9.897	90.103	10.393	89.608
Engineering and engineering trades	52	4.303	95.697	4.514	95.486
Engineering and engineering trades	520	1.705	98.295	2.008	97.992
Mechanics and metal work	521	3.906	96.094	3.708	96.292
Electricity and energy	522	0.638	99.362	0.679	99.321
Electronics and automation	523	0.898	99.103	1.033	98.967
Chemical and process	524	17.556	82.445	19.110	80.890
Motor vehicles, ships and aircraft	525	1.337	98.663	1.541	98.459
Manufacturing and processing	54	48.040	51.960	51.452	48.549
Food processing	541	35.415	64.585	40.330	59.670
Textiles, clothes, footwear, leather	542	89.152	10.848	88.294	11.706
Materials (wood, paper, plastic, glass)	543	12.348	87.652	14.152	85.848

Architecture and building	58	7.208	92.792	7.466	92.534
Architecture and town planning	581	0.000	100.000	4.000	96.000
Building and civil engineering	582	7.225	92.775	7.470	92.530
Agriculture and veterinary	6	40.590	59.410	42.817	57.183
Agriculture, forestry and fishery	62	35.504	64.496	37.111	62.890
Agriculture, forestry and fishery	620	18.602	81.398	11.794	88.206
Crop and livestock production	621	50.902	49.098	53.082	46.918
Horticulture	622	10.291	89.709	12.281	87.719
Forestry	623	3.524	96.476	7.175	92.825
Veterinary	64	92.493	7.507	93.294	6.707
Veterinary	640	92.493	7.507	93.294	6.707
Health and welfare	7	85.937	14.063	85.757	14.243
Health	72	89.110	10.890	89.395	10.605
Health	720	83.333	16.667	86.765	13.235
Nursing and caring	723	89.818	10.182	90.027	9.973
Dental studies	724	88.204	11.796	89.239	10.762
Medical diagnostic and treatment technology	725	58.994	41.006	60.151	39.849
Pharmacy	727	94.331	5.669	94.587	5.414
Social services	76	80.808	19.192	79.754	20.246
Child care and youth services	761	89.352	10.649	90.286	9.714
Social work and counselling	762	79.385	20.615	78.037	21.963
Services	8	41.098	58.902	42.693	57.307
Personal services	81	53.075	46.925	53.423	46.577
Hotel, restaurant and catering	811	40.149	59.851	41.231	58.769
Travel, tourism and leisure	812	70.972	29.028	71.247	28.753
Sports	813	23.936	76.064	23.659	76.341
Domestic services	814	51.113	48.887	54.276	45.725
Hair and beauty services	815	97.551	2.449	97.407	2.593
Transport services	84	17.994	82.006	19.357	80.643
Transport services	840	17.994	82.006	19.357	80.643
Environmental protection	85	6.406	93.594	13.850	86.150
Environmental protection	850	9.140	90.860	19.333	80.667
Environmental protection technology	851	1.053	98.947	0.794	99.206
Security services	86	17.167	82.833	19.039	80.961
Protection of persons and property	861	22.233	77.767	24.371	75.629
Military and defense	863	6.233	93.767	8.013	91.987

Higher vocational education & university

ISCED FIELD	**ISCED code**	**2013/2014 % females**	**2013/2014 % males**	**2014/2015 % females**	**2014/2015 % males**
Education	1	70.835	29.165	70.653	29.347
Teacher training and education science	14	70.835	29.165	70.653	29.347
Teacher training and education science (broad programs)	140	89.440	10.560	89.139	10.861
Education science	142	91.834	8.166	92.044	7.956
Training for teachers at basic levels	144	80.350	19.650	79.467	20.533
Training for teachers with subject specialization	145	54.544	45.456	55.229	44.771
Training for teachers of vocational subjects	146	47.155	52.845	47.095	52.905
Humanities and arts	2	53.563	46.437	53.79	46.21
Liberal arts and sciences	200	62.369	37.631	63.663	36.337
Arts	21	49.901	50.099	49.99	50.01
Arts (broad programs)	210	73.259	26.741	73.566	26.434

Fine arts	211	66.783	33.217	66.413	33.587
Music and performing arts	212	44.331	55.669	43.653	56.347
Audio-visual techniques and media production	213	25.747	74.253	25.693	74.307
Design	214	35.572	64.428	38.072	61.928
Craft skills	215	-	-	-	-
Humanities	22	56.893	43.107	57.064	42.936
Humanities (broad programs)	220	-	-	-	-
Religion	221	53.040	46.960	52.891	47.109
Foreign Languages	222	68.161	31.839	69.339	30.661
Mother Tongue	223	79.110	20.890	78.19	21.81
History and archaeology	225	54.334	45.666	54.301	45.699
Philosophy and ethics	226	37.139	62.861	38.053	61.947
Social sciences, business and law	3	47.805	52.195	47.782	52.218
Social and behavioral science	31	65.068	34.932	65.282	34.718
Social and behavioral science (broad programs)	310	69.428	30.572	70.135	29.865
Psychology	311	73.189	26.811	73.212	26.788
Sociology and cultural studies	312	62.406	37.594	63.564	36.436
Political science and civics	313	43.332	56.668	42.382	57.618
Economics	314	32.746	67.254	37.836	62.164
Journalism and information	32	53.513	46.487	52.01	47.99
Journalism and reporting	321	54.985	45.015	53.205	46.795
Library, information, archive	322	40.838	59.162	39.867	60.133
Business and administration	34	36.098	63.902	36.197	63.803
Business and administration (broad programs)	340	24.717	75.283	24.586	75.414
Wholesale and retail sales	341	27.645	72.355	27.844	72.156
Marketing and advertising	342	56.315	43.685	57.361	42.639
Finance, banking, insurance	343	31.611	68.389	31.605	68.395
Accounting and taxation	344	34.686	65.314	34.747	65.253
Management and administration	345	44.928	55.072	44.636	55.364
Law	38	63.418	36.582	62.946	37.054
Law (broad program)	380	63.418	36.582	62.946	37.054
Science, mathematics and computing	4	23.213	76.787	23.729	76.271
Natural sciences	400	33.751	66.249	33.875	66.125
Life science	42	55.384	44.616	55.658	44.342
Biology and biochemistry	421	55.384	44.616	55.658	44.342
Environmental science	422	55.384	44.616	55.658	44.342
Physical science	44	23.201	76.799	23.255	76.745
Physical science (broad programs)	440	33.835	66.165	30.361	69.639
Physics	441	13.953	86.047	14.618	85.382
Chemistry	442	30.671	69.329	31.994	68.006
Earth science	443	32.835	67.165	32.021	67.979
Mathematics and statistics	46	31.306	68.694	30.97	69.03
Mathematics	461	30.856	69.144	30.76	69.24
Statistics	462	37.576	62.424	34.507	65.493
Computing	48	15.406	84.594	16.256	83.744
Computer science	481	15.406	84.594	16.256	83.744
Engineering, manufacturing and construction	5	19.703	80.297	20.493	79.507
Engineering and engineering trades	52	12.204	87.796	13.259	86.741
Engineering and engineering trades (broad programs)	520	19.667	80.333	20.776	79.224
Mechanics and metal work	521	4.409	95.591	4.831	95.169

Electricity and energy	522	6.143	93.857	6.979	93.021
Electronics and automation	523	3.854	96.146	4.207	95.793
Chemical and process	524	29.446	70.554	30.854	69.146
Motor vehicles, ships and aircraft	525	8.076	91.924	8.437	91.563
Manufacturing and processing	54	68.532	31.468	66.974	33.026
Food processing	541	61.256	38.744	61.344	38.656
Textiles, clothes, footwear, leather	542	90.427	9.573	89.457	10.543
Mining and extraction	544	15.658	84.342	17.493	82.507
Architecture and building	58	22.326	77.674	23.114	76.886
Architecture and town planning	581	32.468	67.532	33.15	66.85
Building and civil engineering	582	15.413	84.587	16.472	83.528
Agriculture and veterinary	6	51.760	48.240	51.746	48.254
Agriculture, forestry and fishery	62	45.038	54.962	45.354	54.646
Agriculture, forestry and fishery (broad programs)	620	27.057	72.943	25.812	74.188
Crop and livestock production	621	54.705	45.295	54.729	45.271
Forestry	623	28.602	71.398	31.104	68.896
Fisheries	624	41.333	58.667	49.383	50.617
Veterinary	640	79.277	20.723	79.608	20.392
Health and welfare	7	72.976	27.024	73.187	26.813
Health and welfare (broad programs)	700	77.941	22.059	76.471	23.529
Health	72	70.469	29.531	70.643	29.357
Health (broad programs)	720	72.666	27.334	72.718	27.282
Medicine	721	65.648	34.352	65.96	34.04
Nursing and caring	723	85.802	14.198	86.454	13.546
Dental studies	724	73.494	26.506	73.956	26.044
Medical diagnostic and treatment technology	725	56.356	43.644	58.037	41.963
Therapy and rehabilitation	726	71.687	28.313	70.93	29.07
Pharmacy	727	61.471	38.529	60.988	39.012
Social services	76	78.286	21.714	78.67	21.33
Child care and youth services	761	97.324	2.676	96.923	3.077
Social work and counselling	762	78.091	21.909	78.463	21.537
Services	8	47.011	52.989	46.891	53.109
Personal services	81	57.917	42.083	57.856	42.144
Hotel, restaurant and catering	811	61.995	38.005	60.509	39.491
Travel, tourism and leisure	812	65.627	34.373	65.305	34.695
Sports	813	29.200	70.800	30.796	69.204
Domestic services	814	55.016	44.984	56.075	43.925
Transport services	84	15.843	84.157	16.44	83.56
Transport services	840	15.843	84.157	16.44	83.56
Environmental protection	85	38.931	61.069	39.543	60.457
Environmental protection (broad programs)	850	40.043	59.957	41.236	58.764
Environmental protection technology	851	27.341	72.659	23.127	76.873
Security services	86	20.098	79.902	22.397	77.603
Security services (broad programs)	860	20.098	79.902	22.397	77.603

Source: Statistics Netherlands (Statistics Netherlands, 2013, 2014, 2015)

Table B.2 *Coding of ISC08 occupations into masculine or feminine fields. Percentage of males and females in occupational fields in the Netherlands based on pooled data (2011-2015) from the European Labour Force survey.*

ISCO08 field	ISCO08 CODE	% females	% males
Commissioned armed forces officers	011	10.242	89.758
Non-commissioned armed forces officers	021	4.372	95.628
Armed forces occupations, other ranks	031	10.814	89.186
Managers	100	24.716	75.284
Chief executives, senior officials and legislators	110	23.698	76.302
Legislators and senior officials	111	32.413	67.587
Managing directors and chief executives	112	18.015	81.985
Business services and administration managers	121	31.351	68.649
Sales, marketing and development managers	122	20.465	79.535
Production managers in agriculture, forestry and fisheries	131	33.977	66.023
Manufacturing, mining, construction, and distribution managers	132	11.100	88.900
Information and communications technology service managers	133	7.199	92.801
Professional services managers	134	43.522	56.478
Hotel and restaurant managers	141	38.472	61.528
Retail and wholesale trade managers	142	27.602	72.398
Other services managers	143	41.386	58.614
Professionals	200	43.339	56.661
Science and engineering professionals	210	34.954	65.046
Physical and earth science professionals	211	20.621	79.379
Mathematicians, actuaries and statisticians	212	27.752	72.248
Life science professionals	213	29.975	70.025
Engineering professionals (excluding electrotechnology)	214	10.001	89.999
Electrotechnology engineers	215	4.478	95.522
Architects, planners, surveyors and designers	216	32.537	67.463
Health professionals	220	71.467	28.533
Medical doctors	221	55.807	44.193
Nursing and midwifery professionals	222	84.764	15.236
Traditional and complementary medicine professionals	223	77.605	22.395
Paramedical practitioners	224	74.457	25.543
Veterinarians	225	57.171	42.829
Other health professionals	226	64.852	35.148
Teaching professionals	230	75.699	24.301
University and higher education teachers	231	45.260	54.740
Vocational education teachers	232	52.828	47.172
Secondary education teachers	233	52.326	47.674
Primary school and early childhood teachers	234	86.234	13.766
Other teaching professionals	235	68.760	31.240
Finance professionals	241	28.820	71.180
Administration professionals	242	45.593	54.407
Sales, marketing and public relations professionals	243	46.213	53.787
Information and communications technology professionals	250	11.708	88.292
Software and applications developers and analysts	251	10.478	89.522
Database and network professionals	252	13.042	86.958
Legal professionals	261	50.105	49.895
Librarians, archivists and curators	262	63.242	36.758
Social and religious professionals	263	70.925	29.075
Authors, journalists and linguists	264	51.389	48.611

Creative and performing artists	265	39.519	60.481
Technicians and associate professionals	300	51.028	48.972
Physical and engineering science technicians	311	12.164	87.836
Mining, manufacturing and construction supervisors	312	7.106	92.894
Process control technicians	313	4.741	95.259
Life science technicians and related associate professionals	314	50.080	49.920
Ship and aircraft controllers and technicians	315	6.300	93.700
Health associate professionals	320	62.962	37.038
Medical and pharmaceutical technicians	321	78.488	21.512
Nursing and midwifery associate professionals	322	88.618	11.382
Veterinary technicians and assistants	324	78.302	21.698
Other health associate professionals	325	76.735	23.265
Financial and mathematical associate professionals	331	47.360	52.640
Sales and purchasing agents and brokers	332	28.812	71.188
Business services agents	333	39.639	60.361
Administrative and specialized secretaries	334	82.167	17.833
Regulatory government associate professionals	335	45.310	54.690
Legal, social and religious associate professionals	341	79.073	20.927
Sports and fitness workers	342	47.413	52.587
Artistic, cultural and culinary associate professionals	343	36.252	63.748
Information and communications technicians	350	8.520	91.480
Information and communications technology operations and user support technicians	351	16.239	83.761
Telecommunications and broadcasting technicians	352	11.359	88.641
Clerical support workers	400	75.506	24.494
General and keyboard clerks	410	79.288	20.712
General office clerks	411	78.785	21.215
Secretaries (general)	412	98.014	1.986
Keyboard operators	413	72.785	27.215
Tellers, money collectors and related clerks	421	57.198	42.802
Client information workers	422	74.029	25.971
Numerical clerks	431	69.333	30.667
Material-recording and transport clerks	432	22.365	77.635
Other clerical support workers	441	59.428	40.572
Personal service workers	510	63.166	36.834
Travel attendants, conductors and guides	511	70.450	29.550
Cooks	512	23.232	76.768
Waiters and bartenders	513	68.324	31.676
Hairdressers, beauticians and related workers	514	90.382	9.618
Building and housekeeping supervisors	515	30.354	69.646
Other personal services workers	516	50.770	49.230
Sales workers	520	39.115	60.885
Street and market salespersons	521	40.436	59.564
Shop salespersons	522	61.674	38.326
Cashiers and ticket clerks	523	90.286	9.714
Other sales workers	524	62.683	37.317
Child care workers and teachers' aides	531	92.374	7.626
Personal care workers in health services	532	94.428	5.572
Protective services workers	541	21.854	78.146
Skilled agricultural, forestry and fishery workers	600	37.134	62.866
Market-oriented skilled agricultural workers	610	14.878	85.122

Market gardeners and crop growers	611	16.208	83.792
Animal producers	612	28.283	71.717
Mixed crop and animal producers	613	19.432	80.568
Fishery workers, hunters and trappers	622	4.396	95.604
Craft and related trades workers	700	17.097	82.903
Building frame and related trades workers	711	1.292	98.708
Building finishers and related trades workers	712	0.869	99.131
Painters, building structure cleaners and related trades workers	713	3.317	96.683
Sheet and structural metal workers, molders and welders, and related workers	721	1.125	98.875
Blacksmiths, toolmakers and related trades workers	722	2.349	97.651
Machinery mechanics and repairers	723	1.252	98.748
Handicraft workers	731	26.307	73693
Printing trades workers	732	22.992	77.008
Electrical equipment installers and repairers	741	2.017	97.983
Electronics and telecommunications installers and repairers	742	4.105	95.895
Food processing, wood working, garment and other craft and related trades workers	750	38.818	61.182
Food processing and related trades workers	751	28.282	71.718
Wood treaters, cabinet-makers and related trades workers	752	5.027	94.973
Garment and related trades workers	753	46.496	53.504
Other craft and related workers	754	46.075	53.925
Stationary plant and machine operators	810	13.151	86.849
Mining and mineral processing plant operators	811	7.851	92.149
Metal processing and finishing plant operators	812	7.997	92.003
Chemical and photographic products plant and machine operators	813	18.183	81.817
Rubber, plastic and paper products machine operators	814	9.468	90.532
Textile, fur and leather products machine operators	815	53.363	46.637
Food and related products machine operators	816	16.956	83.044
Wood processing and papermaking plant operators	817	12.970	87.030
Other stationary plant and machine operators	818	28.348	71.652
Assemblers	821	22.028	77.972
Drivers and mobile plant operators	830	5.801	94.199
Locomotive engine drivers and related workers	831	4.983	95.017
Car, van and motorcycle drivers	832	18.037	81.963
Heavy truck and bus drivers	833	3.350	96.650
Mobile plant operators	834	1.723	98.277
Ships' deck crews and related workers	835	9.149	90.851
Elementary occupations	900	36.547	63.453
Cleaners and helpers	910	58.669	41.331
Domestic, hotel and office cleaners and helpers	911	83.205	16.795
Vehicle, window, laundry and other hand cleaning workers	912	17.344	82.656
Agricultural, forestry and fishery labourers	921	38.537	61.463
Mining and construction labourers	931	2.521	97.479
Manufacturing labourers	932	52.634	47.366
Transport and storage labourers	933	23.380	76.620
Food preparation assistants	941	46.562	53.438
Street vendors (excluding food)	952	32.016	67.984
Refuse workers	961	5.161	94.839
Other elementary workers	962	27.031	72.969

Source: European Labour Force Survey (EU-LFS).

In all analyses in chapter 3 table 3.2 (main text), there are substantial differences between respondents in different levels of secondary education (vocational level, general level and academic level) as well as for adolescents from higher-(lower-)educated parents. To see how horizontal characteristics (parents' occupational field and adolescent's field of study) are intertwined with vertical characteristics (secondary school level and parents' highest education) we ran all analyses displayed in table 3.2 again separately per level of secondary education (table B.3) and for adolescents with a higher-educated background (highest education of parents is higher vocational education or university) and adolescents with an average/lower-educated background (highest education of parents is no education, primary education or secondary education; lower or secondary vocational education (table B.4)). Additionally, because the original sample contained an oversampling of respondents with a non-western immigrant background, we ran all analyses separately for respondents who have a western and non-western background (table B.5). Although all analyses in table B.3, B.4 and B.5 include control variables, we only show the effects of the variables we hypothesized on (mother's occupational field and father's occupational field).

Table B.3 shows no significant effects of parents' occupational field for both boys and girls for adolescents in the vocational level. The results for the general level show that mothers who are employed in a more feminine occupational field will lead boys and girls to more gender stereotypical fields of study and that fathers who are employed in a more masculine occupational field lead boys and girls to less gender stereotypical fields of study. Although it seems that girls are affected more by their mother and father in model 2 and 3, Wald tests show that the effect of mother's occupational field (Wald z-score = 1.86, $p = 0.17$) and father's occupational field (Wald z-score = 0.92, $p = 0.33$) is not statistically different for boys and girls in model 2. However, in model 3 mother's occupational field is statistically different for boys and girls (model 3: Wald z-score = 4.18, $p < 0.05$). Model 2 and 3 show that boys in the academic level have more gender stereotypical fields of study if their father has a more masculine occupational field. This effect is significantly different for boys and girls (model 2: Wald z-score = 4.13, $p < 0.05$; model 3: Wald z-score = 4.21, $p < 0.05$). These models do show same-sex effects for the general and academic level.

Table B.4 shows the results from adolescents from lower/average-educated backgrounds and higher-educated backgrounds. Model 1 in table B.4 show that mother's occupational field lead boys and girls to more gender stereotypical fields of study for adolescents who have lower/average-educated parents, but not adolescents from higher-educated backgrounds. These effects are not different for boys and girls. Model 2 and 3 show that father's masculine occupational field leads girls from higher-educated parents to less gender stereotypical fields of study, but boys to more gender stereotypical fields of study. The effect of father's masculine occupational field is significantly different for boys and girls in model 2 (Wald z-score = 7.93, $p < .01$) and model 3 (Wald z-score = 9.95, $p < 0.01$). Model 3 additionally shows that especially a more dominant father who is employed in a more masculine occupation will lead girls to less feminine fields of study.

Table B.5 shows the results for people with a western background and people with a non-western immigrant background. Model 1 shows that mother's occupational field is important for respondents with a non-western immigrant background. A 10 percent increase in the share of women in mother's occupational field is associated with around 2 percent increase in the share of own-gender students in adolescent's occupational field. This effect is not different for boys and girls (model 2: Wald z-score = 0.39, $p = 0.53$; model 3: Wald z-score = 0.06, $p = 0.80$). Father's

occupational field does not seem to affect adolescent's field of study for both adolescents with a western and non-western background.

Table B.3 *By level of secondary education: Unstandardized coefficients and standard errors of multiple-group analyses of predictors of masculine field of study choice for boys and feminine field of study choice for girls who live in two-parents households.*

	Model 1		Model 2		Model 3	
	Boys	Girls	Boys	Girls	Boys	Girls
	B		*B*	*B*	*B*	*B*
	(SE)		*(SE)*	*(SE)*	*(SE)*	*(SE)*
Independent variables			Vocational level (n = 1320)			
Femininity of mother's occupation	0.05		0.07	0.05	0.06	0.05
	(0.03)		(0.07)	(0.04)	(0.07)	(0.05)
Masculinity of father's occupation	0.01		0.04	-0.02	0.04	-0.01
	(0.03)		(0.04)	(0.03)	(0.04)	(0.04)
Father's dominance					-12.18	32.98
					(41.56)	(28.14)
Femininity of mother's occupation					0.51	-0.11
× Father's dominance					(0.44)	(0.34)
Masculinity of father's occupation					-0.37	-0.35
× Father's dominance					(0.35)	(0.30)
Constant	71.77***	71.23***	68.67***	73.44***	68.81***	72.66***
	(3.65)	(3.67)	(5.74)	(4.40)	(5.66)	(4.69)
			General level (n = 717)			
Femininity of mother's occupation	0.08**		0.01	0.13*	-0.02	0.16**
	(0.03)		(0.06)	(0.05)	(0.05)	(0.05)
Masculinity of father's occupation	-0.07**		-0.02	-0.11**	-0.01	-0.11***
	(0.02)		(0.06)	(0.03)	(0.07)	(0.03)
Father's dominance					7.87	26.48
					(28.80)	(31.46)
Femininity of mother's occupation					0.24	-0.33
× Father's dominance					(0.29)	(0.37)
Masculinity of father's occupation					-0.12	-0.34
× Father's dominance					(0.38)	(0.34)
Constant	67.04***	64.63***	69.57***	64.18***	69.35***	63.34***
	(3.58)	(3.79)	(6.16)	(6.13)	(6.19)	(5.84)
			Academic level (n = 460)			
Femininity of mother's occupation	0.07		0.09	0.05	0.08	0.06
	(0.04)		(0.05)	(0.06)	(0.07)	(0.06)
Masculinity of father's occupation	0.07		0.19*	-0.02	0.20*	-0.01
	(0.04)		(0.08)	(0.04)	(0.08)	(0.04)
Father's dominance					64.17	128.08*
					(83.67)	(61.37)
Femininity of mother's occupation					-0.48	-0.89
× Father's dominance					(0.86)	(0.55)
Masculinity of father's occupation					-0.33	-0.93
× Father's dominance					(0.50)	(0.60)
Constant	58.91***	54.84***	49.48***	61.40***	49.20***	60.39***
	(5.09)	(5.01)	(7.67)	(5.73)	(8.18)	(5.39)

Source: Wave 1 and wave 2 of Children of Immigrants Longitudinal Survey in four European Countries and wave 4 and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table B.4 *By parents' highest education: Unstandardized coefficients and standard errors of multiple-group analyses of predictors of masculine field of study choice for boys and feminine field of study choice for girls who live in two-parents household.*

	Model 1		Model 2		Model 3	
	Boys	Girls	Boys	Girls	Boys	Girls
	B		*B*	*B*	*B*	*B*
	(SE)		*(SE)*	*(SE)*	*(SE)*	*(SE)*
Independent variables	Lower/average-educated parents (n = 1465)					
Femininity of mother's occupation	0.07*		0.03	0.08*	0.02	0.09*
	(0.03)		(0.04)	(0.03)	(0.04)	(0.04)
Masculinity of father's occupation	0.00		0.01	-0.01	0.01	-0.01
	(0.02)		(0.04)	(0.03)	(0.04)	(0.03)
Father's dominance					-19.57	37.04
					(40.86)	(27.10)
Femininity of mother's occupation					0.46	-0.30
× Father's dominance					(0.40)	(0.31)
Masculinity of father's occupation					-0.24	-0.28
× Father's dominance					(0.31)	(0.26)
Constant	66.48***	64.32***	71.23***	66.55***	70.94***	65.71***
	(3.99)	(3.86)	(4.44)	(3.16)	(4.42)	(3.27)
	Higher-educated parents (n = 1032)					
Femininity of mother's occupation	0.07		0.08	0.06	0.07	0.07
	(0.04)		(0.06)	(0.04)	(0.06)	(0.05)
Masculinity of father's occupation	-0.02		0.07	-0.09**	0.09*	-0.09**
	(0.03)		(0.04)	(0.03)	(0.05)	(0.03)
Father's dominance					49.08	61.10
					(35.72)	(32.99)
Femininity of mother's occupation					-0.12	-0.21
× Father's dominance					(0.37)	(0.34)
Masculinity of father's occupation					-0.36	-0.77*
× Father's dominance					(0.30)	(0.34)
Constant	75.13***	73.70***	58.22***	68.23***	57.68***	67.80***
	(6.71)	(6.71)	(4.37)	(3.55)	(4.26)	(3.56)

Source: Wave 1 and wave 2 of Children of Immigrants Longitudinal Survey in four European Countries and wave 4 and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Table B.5 *By immigrant background: Unstandardized coefficients and standard errors of multiple-group analyses of predictors of masculine field of study choice for boys and feminine field of study choice for girls who live in two-parents household.*

	Model 2		Model 3		Model 4	
	Boys	Girls	Boys	Girls	Boys	Girls
	B		*B*	*B*	*B*	*B*
	(SE)		*(SE)*	*(SE)*	*(SE)*	*(SE)*
Independent variables	Western background (n = 2075)					
Femininity of mother's occupation	0.04		0.02	0.05	0.01	0.06*
	(0.02)		(0.04)	(0.03)	(0.04)	(0.03)
Masculinity of father's occupation	0.01		0.06	-0.04	0.07*	-0.03
	(0.02)		(0.03)	(0.02)	(0.03)	(0.03)
Father's dominance					14.30	42.31
					(31.01)	(22.14)
Femininity of mother's occupation					0.19	-0.19
× Father's dominance					(0.29)	(0.25)
Masculinity of father's occupation					-0.36	-0.50
× Father's dominance					(0.25)	(0.26)
Constant	73.41***	71.22***	70.89***	73.48***	70.48***	72.51***
	(2.81)	(2.85)	(3.50)	(3.24)	(3.53)	(3.27)
	Non-western background (n = 422)					
Femininity of mother's occupation	0.23***		0.27***	0.21***	0.24**	0.22***
	(0.05)		(0.08)	(0.06)	(0.09)	(0.07)
Masculinity of father's occupation	-0.07		-0.11	-0.04	-0.10	-0.05
	(0.04)		(0.07)	(0.05)	(0.07)	(0.05)
Father's dominance					-95.84	23.62
					(83.59)	(49.90)
Femininity of mother's occupation					1.18	-0.45
× Father's dominance					(0.72)	(0.56)
Masculinity of father's occupation					0.27	0.07
× Father's dominance					(0.72)	(0.40)
Constant	54.31***	55.13***	54.67***	54.74***	54.23***	54.90***
	(5.77)	(5.78)	(8.46)	(6.17)	(8.33)	(6.28)

Source: Wave 1 and wave 2 of Children of Immigrants Longitudinal Survey in four European Countries and wave 4 and wave 5 of Children of Immigrants Longitudinal Survey in the Netherlands, own calculations. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Appendix C

Table C.1 *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
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 C.2 *ISCO08 fields coded in five categories.*

ISCO08 field	ISCO8 code	Label	Code
Managers	**1**		
Legislators and senior officials	111	Business & law	1
Managing directors and chief executives	112	Business & law	1
Business services and administration managers	121	Business & law	1
Sales, marketing and development managers	122	Business & law	1
Production managers in agriculture, forestry and fisheries	131	Health, biology, agriculture & veterinary	3
Manufacturing, mining, construction and distribution managers	132	Science & engineering	2
Information and communications technology services managers	133	Science & engineering	2
Professional services managers	134	Business & law	1
Hotel and restaurant managers	141	Services	4
Retail and wholesale trade managers	142	Business & law	1
Other services managers	143	Services	4
Professionals	**2**		
Physical and earth science professionals	211	Health, biology, agriculture & veterinary	3
Mathematicians, actuaries and statisticians	212	Science & engineering	2
Life science professionals	213	Health, biology, agriculture & veterinary	3
Engineering professionals (excluding electrotechnology)	214	Science & engineering	2
Electrotechnology engineers	215	Science & engineering	2
Architects, planners, surveyors and designers	216	Science & engineering	2
Medical doctors	221	Health, biology, agriculture & veterinary	3
Nursing and midwifery professionals	222	Health, biology, agriculture & veterinary	3
Traditional and complementary medicine professionals	223	Health, biology, agriculture & veterinary	3
Paramedical practitioners	224	Health, biology, agriculture & veterinary	3
Veterinarians	225	Health, biology, agriculture & veterinary	3
Other health professionals	226	Health, biology, agriculture & veterinary	3
University and higher education teachers	231	Education, humanities, arts & social sciences	0
Vocational education teachers	232	Education, humanities, arts & social sciences	0
Secondary education teachers	233	Education, humanities, arts & social sciences	0
Primary school and early childhood teachers	234	Education, humanities, arts & social sciences	0
Other teaching professionals	235	Education, humanities, arts & social sciences	0
Finance professionals	241	Business & law	1
Administration professionals	242	Business & law	1
Sales, marketing and public relations professionals	243	Business & law	1
Software and applications developers and analysts	251	Science & engineering	2
Database and network professionals	252	Science & engineering	2
Legal professionals	261		1
Librarians, archivists and curators	262	Education, humanities, arts & social sciences	0
Social and religious professionals	263	Education, humanities, arts & social sciences	0
Authors, journalists and linguists	264	Education, humanities, arts & social sciences	0
Creative and performing artists	265	Education, humanities, arts & social sciences	0
Technicians and associate professionals	**3**		
Physical and engineering science technicians	311	Science & engineering	2
Mining, manufacturing and construction supervisors	312	Science & engineering	2
Process control technicians	313	Science & engineering	2
Life science technicians and related associate professionals	314	Science & engineering	2
Ship and aircraft controllers and technicians	315	Science & engineering	2
Medical and pharmaceutical technicians	321	Health, biology, agriculture & veterinary	3
Nursing and midwifery associate professionals	322	Health, biology, agriculture & veterinary	3
Traditional and complementary medicine associate professionals	323	Health, biology, agriculture & veterinary	3
Veterinary technicians and assistants	324	Health, biology, agriculture & veterinary	3

Other health associate professionals	325	Health, biology, agriculture & veterinary	3
Financial and mathematical associate professionals	331	Business & law	1
Sales and purchasing agents and brokers	332	Business & law	1
Business services agents	333	Business & law	1
Administrative and specialized secretaries	334	Business & law	1
Government regulatory associate professionals	335	Business & law	1
legal, social and religious associate professionals	341	Education, humanities, arts & social sciences	0
Sports and fitness workers	342	Services	4
Artistic, cultural and culinary associate professionals	343	Education, humanities, arts & social sciences	0
Information and communications technology operations and user support technicians	351	Science & engineering	2
Telecommunications and broadcasting technicians	352	Science & engineering	2
Clerical support workers	**4**		
General office clerks	411	Business & law	1
Secretaries (general)	412	Business & law	1
Keyboard operators	413	Business & law	1
Tellers, money collectors and related clerks	421	Business & law	1
Client information workers	422	Business & law	1
Numerical clerks	431	Business & law	1
Material recording and transport clerks	432	Business & law	1
Other clerical support workers	441	Business & law	1
Services and sales workers	**5**		
Travel attendants, conductors and guides	511	Services	4
Cooks	512	Services	4
Waiters and bartenders	513	Services	4
Hairdressers, beauticians and related workers	514	Services	4
Building and housekeeping supervisors	515	Services	4
Other personal services workers	516	Services	4
Street and market salespersons	521	Services	4
Shop salespersons	522	Services	4
Cashiers and ticket clerks	523	Services	4
Other sales workers	524	Services	4
Child care workers and teachers' aides	531	Education, humanities, arts & social sciences	0
Personal care workers in health services	532	Health, biology, agriculture & veterinary	3
Protective services workers	541	Services	4
Skilled agricultural, forestry and fishery workers	**6**		
Market gardeners and crop growers	611	Health, biology, agriculture & veterinary	3
Animal producers	612	Health, biology, agriculture & veterinary	3
Mixed crop and animal producers	613	Health, biology, agriculture & veterinary	3
Forestry and related workers	621	Health, biology, agriculture & veterinary	3
Fishery workers, hunters and trappers	622	Health, biology, agriculture & veterinary	3
Subsistence crop farmers	631	Health, biology, agriculture & veterinary	3
Subsistence livestock farmers	632	Health, biology, agriculture & veterinary	3
Subsistence mixed crop and livestock farmers	633	Health, biology, agriculture & veterinary	3
Subsistence fishers, hunters, trappers and gatherers	634	Health, biology, agriculture & veterinary	3
Craft and related trades workers	**7**		2
Building frame and related trades workers	711	Science & engineering	2
Building finishers and related trades workers	712	Science & engineering	2
Painters, building structure cleaners and related trades workers	713	Science & engineering	2
Sheet and structural metal workers, moulders and welders, and related workers	721	Science & engineering	2
Blacksmiths, toolmakers and related trades workers	722	Science & engineering	2
Machinery mechanics and repairers	723	Science & engineering	2
Handicraft workers	731	Science & engineering	2
Printing trades workers	732	Science & engineering	2

Electrical equipment installers and repairers	741	Science & engineering	2
Eepairers	742	Science & engineering	2
Food processing and related trades workers	751	Science & engineering	2
Wood treaters, cabinet-makers and related trades workers	752	Science & engineering	2
Garment and related trades workers	753	Science & engineering	2
Other craft and related workers	754	Science & engineering	2
Plant and machine operators and assemblers	**8**		
Mining and mineral processing plant operators	811	Science & engineering	2
Metal processing and finishing plant operators	812	Science & engineering	2
Chemical and photographic products plant and machine operators	813	Science & engineering	2
Rubber, plastic and paper products machine operators	814	Science & engineering	2
Textile, fur and leather products machine operators	815	Science & engineering	2
Food and related products machine operators	816	Science & engineering	2
Wood processing and papermaking plant operators	817	Science & engineering	2
Other stationary plant and machine operators	818	Science & engineering	2
Assemblers	821	Science & engineering	2
Locomotive engine drivers and related workers	831	Services	4
Car, van and motorcycle drivers	832	Services	4
Heavy truck and bus drivers	833	Services	4
Mobile plant operators	834	Science & engineering	2
Ships' deck crews and related workers	835	Services	4
Elementary occupations	**9**		
Domestic, hotel and office cleaners and helpers	911	Services	4
Vehicle, window, laundry and other hand cleaning workers	912	Services	4
agricultural, forestry and fishery labourers	921	Health, biology, agriculture & veterinary	3
Mining and construction labourers	931	Science & engineering	2
Manufacturing labourers	932	Science & engineering	2
Transport and storage labourers	933	Services	4
Food preparation assistants	941	Services	4
Street and related services workers	951	Services	4
Street vendors (excluding food)	952	Services	4
Refuse workers	961	Services	4
Other elementary workers	962	Services	4
Armed forces occupations	**0**		
Commissioned armed forces officers	11	Services	4
Non-commissioned armed forces officers	21	Services	4
Armed forces occupations, other ranks	31	Services	4

Table C.3 *Results of conditional logit models (log-odds) of how older sibling's characteristics affect younger sibling's field of study choice. The effects of the control variables (N = 1607).*

Controls	Model 1	Model 2	Model 3	Model 4
Age younger sibling ×				
Business and law	-0.06*	-0.06*	-0.06*	-0.06*
	(0.03)	(0.03)	(0.03)	(0.03)
Science and engineering	-0.06	-0.06	-0.06	-0.06
	(0.04)	(0.04)	(0.04)	(0.04)
Health, biology, agriculture and veterinary	-0.01	-0.01	-0.01	-0.01
	(0.03)	(0.03)	(0.03)	(0.03)
Services	-0.03	-0.03	-0.03	-0.02
	(0.04)	(0.04)	(0.04)	(0.04)
Education, humanities, arts, and social sciences (ref)	-	-	-	-
Secondary vocational education (ref)	-	-	-	-
Higher vocational education ×				
Business and law	0.44**	0.44**	0.44**	0.44**
	(0.17)	(0.17)	(0.17)	(0.17)
Science and engineering	-0.14	-0.14	-0.13	-0.13
	(0.21)	(0.21)	(0.22)	(0.22)
Health, biology, agriculture and veterinary	-0.05	-0.05	-0.04	-0.06
	(0.17)	(0.17)	(0.17)	(0.17)
Services	-0.99***	-0.99***	-0.99***	-0.99***
	(0.21)	(0.21)	(0.20)	(0.21)
Education, humanities, arts, and social sciences (ref)	-	-	-	-
University ×				
Business and law	0.05	0.05	0.05	0.06
	(0.20)	(0.20)	(0.20)	(0.20)
Science and engineering	-0.12	-0.12	-0.10	-0.13
	(0.25)	(0.25)	(0.25)	(0.26)
Health, biology, agriculture and veterinary	-0.25	-0.25	-0.23	-0.25
	(0.22)	(0.22)	(0.22)	(0.22)
Services	-3.67***	-3.67***	-3.64***	-3.68***
	(0.72)	(0.72)	(0.72)	(0.72)
Education, humanities, arts, and social sciences (ref)	-	-	-	-
Girl ×				
Business and law	-1.44***	-1.44***	-1.44***	
	(0.16)	(0.16)	(0.16)	
Science and engineering	-2.77***	-2.77***	-2.77***	
	(0.20)	(0.20)	(0.20)	
Health, biology, agriculture and veterinary	-0.09	-0.09	-0.09	
	(0.19)	(0.19)	(0.19)	
Services	-1.18***	-1.18***	-1.19***	
	(0.19)	(0.19)	(0.19)	
Education, humanities, arts, and social sciences (ref)	-	-	-	
Older sister - younger sister (ref)				-
Older brother - younger brother ×				
Business and law				1.20***
				(0.31)
Science and engineering				2.43***
				(0.35)
Health, biology, agriculture and veterinary				-0.01
				(0.35)
Services				1.04***
				(0.31)
Education, humanities, arts, and social sciences (ref)				-

Older sister - younger brother ×				
Business and law				1.38***
				(0.33)
Science and engineering				2.84***
				(0.36)
Health, biology, agriculture and veterinary				0.34
				(0.37)
Services				1.18***
				(0.36)
Education, humanities, arts, and social sciences (ref)				-
Older brother - younger sister ×				
Business and law				-0.19
				(0.24)
Science and engineering				-0.15
				(0.37)
Health, biology, agriculture and veterinary				0.18
				(0.22)
Services				-0.10
				(0.25)
Education, humanities, arts, and social sciences (ref)				-
Highest education level of the parents ×				
Business and law	-0.06	-0.06	-0.06	-0.06
	(0.06)	(0.06)	(0.06)	(0.06)
Science and engineering	-0.05	-0.05	-0.05	-0.04
	(0.08)	(0.08)	(0.08)	(0.08)
Health, biology, agriculture and veterinary	-0.09	-0.09	-0.09	-0.09
	(0.07)	(0.07)	(0.07)	(0.07)
Services	-0.07	-0.07	-0.07	-0.07
	(0.08)	(0.08)	(0.08)	(0.08)
Education, humanities, arts, and social sciences (ref)	-	-	-	-
Non-western immigrant ×				
Business and law	0.77***	0.77***	0.78***	0.80***
	(0.19)	(0.19)	(0.19)	(0.19)
Science and engineering	0.06	0.06	0.06	0.05
	(0.26)	(0.26)	(0.26)	(0.27)
Health, biology, agriculture and veterinary	0.15	0.15	0.16	0.15
	(0.20)	(0.20)	(0.20)	(0.21)
Services	-0.11	-0.11	-0.11	-0.15
	(0.24)	(0.24)	(0.25)	(0.25)
Education, humanities, arts, and social sciences (ref)	-	-	-	-
Business and law	2.05**	2.05**	2.06**	0.84
	(0.65)	(0.65)	(0.65)	(0.63)
Science and engineering	2.33**	2.33**	2.35**	-0.39
	(0.80)	(0.80)	(0.80)	(0.82)
Health, biology, agriculture and veterinary	0.44	0.44	0.46	0.24
	(0.63)	(0.63)	(0.63)	(0.63)
Services	1.64	1.64	1.66	0.58
	(0.89)	(0.89)	(0.89)	(0.88)
Education, humanities, arts, and social sciences (ref)	-	-	-	-
Log likelihood	-2261.04	-2261.01	-2260.38	-2251.23
Df	29.00	30.00	30.00	56.00
χ^2	460.80	461.35	460.01	483.86

Source: Wave 1 and wave 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 C.4 *Results of conditional logit models (log-odds) of sibling influence in field of study choice; effect of the oldest sibling (n = 1607).*

	Model 1	Model 2	Model 3	Model 4
Oldest sibling's field of study	0.51***	0.50***	0.57***	0.48*
(1: option chosen 0: not chosen)	(0.06)	(0.09)	(0.07)	(0.21)
Oldest sibling's field of study ×				
Age differences		0.00		
		(0.02)		
Oldest sibling higher level of education			-0.18	
			(0.13)	
Similar education level/younger sibling higher educated			-	
Oldest brother - younger brother				0.50
				(0.41)
Oldest sister - younger brother				0.20
				(0.41)
Oldest brother - younger sister				-0.19
				(0.32)
Oldest sister - younger sister (ref)				-
Oldest brother - younger brother ×				
Business and law				0.06
				(0.61)
Science and engineering				-1.59*
				(0.72)
Health, biology, agriculture and veterinary				0.24
				(0.71)
Services				-0.44
				(0.73)
Education, humanities, arts, and social sciences (ref)				-
Oldest sister - younger brother ×				
Business and law				-0.18
				(0.60)
Science and engineering				-1.37
				(0.85)
Health, biology, agriculture and veterinary				-0.10
				(0.66)
Services				0.48
				(0.69)
Education, humanities, arts, and social sciences (ref)				-
Oldest brother - younger sister ×				
Business and law				0.06
				(0.52)
Science and engineering				-1.51*
				(0.75)
Health, biology, agriculture and veterinary				0.68
				(0.54)
Services				0.13
				(0.60)
Education, humanities, arts, and social sciences (ref)				-
Oldest sister – younger sister × all fields (ref)				-
Oldest sibling's field of study ×				
Business and law				-0.11
				(0.36)
Science and engineering				1.14*
				(0.55)

Health, biology, agriculture and veterinary				-0.03
				(0.36)
Services				-0.20
				(0.41)
Education, humanities, arts, and social sciences (ref)				-
Log likelihood	-2263.79	-2263.79	-2262.75	-2250.06
Df	29.00	30.00	30.00	56.00
χ^2	466.93	467.39	465.24	485.08

Source: Wave 1 and wave 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 C.5 *Results of conditional logit models (log-odds) of sibling influence in field of study choice. The effects of the oldest sibling for siblings with more than one older sibling and whose sibling is not also the older closest in age (n = 406).*

	Model 1	Model 2	Model 3	Model 4
Oldest sibling's field of study	0.45***	0.46	0.40*	0.63
(1: option chosen 0: not chosen)	(0.12)	(0.24)	(0.15)	(0.40)
Oldest sibling's field of study ×				
Age differences		-0.00		
		(0.03)		
Oldest sibling higher level of education			0.13	
			(0.24)	
Similar education level/younger sibling higher educated			-	
Oldest brother - younger brother				-0.05
				(0.86)
Oldest sister - younger brother				0.28
				(0.99)
Oldest brother - younger sister				-1.06
				(0.65)
Oldest sister - younger sister (ref)				-
Oldest brother - younger brother ×				
Business and law				1.47
				(1.28)
Science and engineering				-2.41
				(1.81)
Health, biology, agriculture and veterinary				1.92
				(1.34)
Services				0.70
				(1.75)
Education, humanities, arts, and social sciences (ref)				-
Oldest sister - younger brother ×				
Business and law				-0.20
				(1.32)
Science and engineering				-2.49
				(1.47)
Health, biology, agriculture and veterinary				-0.16
				(1.36)
Services				1.12
				(1.62)
Education, humanities, arts, and social sciences (ref)				-
Oldest brother - younger sister ×				
Business and law				0.87
				(1.06)
Science and engineering				-1.41
				(1.79)
Health, biology, agriculture and veterinary				2.87*
				(1.14)
Services				1.83
				(1.31)
Education, humanities, arts, and social sciences (ref)				-
Oldest sister – younger sister × all fields (ref)				-
Oldest sibling's field of study ×				
Business and law				-0.54
				(0.74)

Science and engineering				1.45
				(1.43)
Health, biology, agriculture and veterinary				-0.34
				(0.66)
Services				-0.92
				(0.99)
Education, humanities, arts, and social sciences (ref)				-
Log likelihood	-564.67	-564.67	-564.53	-549.49
df	29.00	30.00	30.00	56.00
χ^2	144.74	145.79	145.94	153.29

Source: Wave 1 and wave 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 C.6 *Results of conditional logit models (log-odds) of sibling influence in field of study choice, sequential and cumulative effects (N = 1607).*

	Model 1	Model 2	Model 3	Model 4	Model5	Model 6	Model 7
Field of study sibling closest in age	0.53***			0.51***	0.51***	0.52***	0.52***
	(0.06)			(0.06)	(0.06)	(0.06)	(0.06)
Field of study sibling second closest in age		0.49***		0.41***	0.41***	0.43**	0.36*
		(0.12)		(0.12)	(0.12)	(0.15)	(0.16)
Field of study sibling third closest in age			0.44		0.45		0.06
			(0.30)		(0.30)		(0.45)
Field of study sibling closest in age × Field of study sibling second closest in age						-0.04	-0.02
						(0.26)	(0.26)
Field of study sibling closest in age × Field of study sibling third closest in age							-0.22
							(0.84)
Field of study sibling second closest in age × Field of study sibling third closest in age							1.77*
							(0.86)
Field of study sibling closest in age × Field of study sibling second closest in age × Field of study sibling third closest in age							-0.18
							(1.54)
Log likelihood	-2088.33	-2292.83	-2300.22	-2085.01	-2083.92	-2077.20	-2072.68
df	29.00	29.00	29.00	30.00	31.00	31.00	35.00
χ^2	808.92	427.60	405.93	821.02	821.89	805.01	808.73

Source: Wave 1 and wave 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. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Appendix D

Table D.1 *Coding of STEM fields.*

Non-STEM fields			
10	Basic/broad, general programs	761	Child care and youth services
80	Literacy and numeracy	762	Social work and counselling
90	Personal skills	811	Hotel, restaurant and catering
140	Teacher training and education science	812	Travel, tourism and leisure
142	Education science	813	Sports
143	Training for pre-school teachers	814	Domestic services
144	Training for teachers at basic levels	815	Hair and beauty services
145	Training for teachers with subject specialization	840	Transport services
146	Training for teachers of vocational subjects	850	Environmental protection
200	Humanities and Arts	851	Environmental protection technology
210	Arts	852	Natural environments and wildlife
211	Fine arts	861	Protection of persons and property
212	Music and performing arts	862	Occupational health and safety
213	Audio-visual techniques and media production	863	Military and defense
214	Design		
215	Craft skills	**STEM Fields**	
220	Humanities	400	Science, Mathematics and Computing
221	Religion	440	Physical science
222	Foreign languages	441	Physics
223	Mother tongue	420	Life science
225	History and archaeology	421	Biology and biochemistry
226	Philosophy and ethics	422	Environmental science
310	Social and behavioral science	442	Chemistry
311	Psychology	443	Earth science
312	Sociology and cultural studies	461	Mathematics
313	Political science and civics	462	Statistics
314	Economics	481	Computer science
320	Journalism and information	482	Computer use
321	Journalism and reporting	500	Engineering, Manufacturing & Construction
322	Library, information, archive	520	Engineering and engineering trades
340	Business and administration	521	Mechanics and metal work
341	Wholesale and retail sales	522	Electricity and energy
342	Marketing and advertising	523	Electronics and automation
343	Finance, banking, insurance	524	Chemical and process
344	Accounting and taxation	525	Motor vehicles, ships and aircraft
345	Management and administration	541	Food processing
346	Secretarial and office work	542	Textiles, clothes, footwear, leather
380	Law	543	Materials (wood, paper, plastic, glass)
620	Agriculture, forestry and fishery	544	Mining and extraction
621	Crop and livestock production	581	Architecture and town planning
622	Horticulture	582	Building and civil engineering
623	Forestry		
624	Fisheries		
640	Veterinary		
700	Health and Welfare		
720	Health		
721	Medicine		
723	Nursing and caring		
724	Dental studies		
725	Medical diagnostic and treatment technology		
726	Therapy and rehabilitation		
727	Pharmacy		
760	Social services		

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Dutch summary/Nederlandse samenvatting

Achtergrond van de studie

Jongens kiezen nog steeds vaker voor genderstereotiepe mannelijke studies zoals wiskunde en techniek (bètastudies) en meisjes vaker voor genderstereotiepe vrouwelijke studies zoals onderwijs en talen (alfastudies). Lang werd gedacht dat jongens beter waren in bètavakken, maar steeds meer onderzoek toont aan dat meisjes beter presteren. Dat meisjes toch niet kiezen voor bètastudies, betekent dat ze lucratieve carrières mislopen in vakgebieden waar ze wel goed in zijn. Aangezien de bètawetenschappen een drijvende kracht zijn achter de economische groei van de Nederlandse samenleving, zou ook de samenleving baat hebben bij meer getalenteerde meisjes die afstuderen in deze richtingen. Voorgaand onderzoek heeft zich vooral gericht op de redenen waarom meisjes niet voor bètastudies kiezen, maar er is weinig onderzoek dat zich richt op waarom jongens niet voor genderstereotiepe vrouwelijke richtingen kiezen. Jongens lopen namelijk zo ook carrières mis die passen bij hun interesses en capaciteiten. Daarnaast is het niet alleen zo dat de Nederlandse samenleving zou profiteren van meer meisjes die afstuderen in bètastudies, maar ook van getalenteerde jongens die afstuderen in genderstereotiepe vrouwelijke richtingen zoals het onderwijs of de zorg. Om gendersegregatie in studierichtingen te verminderen, is het belangrijk om te weten waarom jongens en meisjes verschillende studierichtingen kiezen. Deze dissertatie onderzoekt verschillende verklaringen voor de studiekeuzes van jongeren, met een specifieke focus op welke factoren verschillende studierichtingen voor jongens en meisjes bevorderen.

Doordat sekseverschillen in studierichtingen niet verklaard kunnen worden door verschillen in capaciteiten of prestaties, heeft steeds meer onderzoek zich toegelegd op hoe de sociale omgeving van adolescenten jongens en meisjes socialiseert naar verschillende studierichtingen. Hoewel deze socialisatieprocessen vaak genoemd worden als mogelijke verklaring voor sekseverschillen in studiekeuzes, zijn er weinig studies die deze verklaringen daadwerkelijk toetsen. Dit proefschrift onderzoekt drie manieren waarop de sociale omgeving van adolescenten studiekeuzes beïnvloedt en test hoe deze invloed voor jongens en meisjes verschilt.

Invloed van de sociale omgeving

De sociale omgeving kan ten eerste van invloed zijn op studiekeuzes via *geïnternaliseerde genderrolverwachtingen* van adolescenten. Genderrolverwachtingen zijn verwachtingen uit de omgeving van adolescenten (ouders, vrienden, leraren, media etc.) over wat "typisch" of "correct" mannelijk of vrouwelijk gedrag is. Traditionele genderrolverwachtingen houden voor mannen in dat zij voor het inkomen zorgen, rationeel zijn, en geïnteresseerd zijn in wiskunde en techniek. Voor vrouwen houden traditionele genderrolverwachtingen in dat zij voor de kinderen en het huishouden zorgen, emotioneel zijn, en geïnteresseerd in taal en verzorging. Hoewel adolescenten zelf hun studierichting kiezen, worden deze keuzes beïnvloed door de genderrolverwachtingen van hun omgeving. Adolescenten nemen deze verwachtingen over en gaan zich ernaar gedragen uit angst om door hun omgeving afgewezen te worden. Studierichtingkeuzes op basis van deze geïnternaliseerde genderrolverwachtingen kunnen leiden tot sekseverschillen in studierichtingen. Dit is het eerste onderzoek die test hoe genderrolverwachtingen sekseverschillen in studiekeuzes genereert.

De sociale omgeving kan ook een directe invloed hebben. Een tweede invloed van de sociale omgeving van jongeren bestaat uit de invloed van het *gezin*. Binnen het gezin zijn *ouders* van grote invloed op de studieloopbaan van hun kinderen. Voorgaande studies hebben vaker

onderzocht hoe de hoogst genoten opleiding of beroepsstatus van ouders, zogeheten hiërarchische kenmerken, invloed hebben op de studiekeuzes van jongeren. Er is echter weinig onderzoek dat kijkt naar *welk* beroep ouders hebben (niet-hiërarchisch kenmerk), terwijl juist het beroepsveld van ouders een grote invloed kan hebben op de studierichting van hun kind. De focus van dit onderzoek ligt niet alleen op het beroep van de vader, zoals in voorgaande studies, maar ook op het beroep van de moeder. Niet ieder kind woont echter bij beide ouders en de invloed van vader of moeder kan verschillen afhankelijk van bij welke ouder het kind woont. Kinderen van gescheiden ouders wonen veelal bij hun moeder. We weten dat kinderen in eenoudergezinnen vaak minder goed presteren op school en zonder diploma van school gaan, maar er is weinig bekend over de mogelijke gevolgen voor hun studiekeuzes. Deze dissertatie onderzoekt of de invloed van ouders op de studierichting van jongeren verschilt tussen tweeoudergezinnen en jongeren die alleen bij hun moeder wonen.

Naast ouders, zijn *broers of zussen* een belangrijk onderdeel van het gezin. Er is veel literatuur over hoe broers en zussen deviant gedrag bevorderen (alcoholgebruik, roken etc.), maar het is pas recentelijk dat meer onderzoek zich is gaan richten op hoe broers en zussen invloed hebben op school-gerelateerde uitkomsten. Oudere broers en zussen beïnvloeden onder andere de schoolkeuze of schoolprestaties van hun jongere broers en zussen, maar de gevolgen voor studiekeuzes zijn nog niet onderzocht. Gegeven het feit dat oudere broers en zussen vaak net zelf een studiekeuze hebben gemaakt, zouden zij een grote rol kunnen spelen in de studiekeuzes van hun jongere broer en zus.

Een derde invloed van de sociale omgeving bestaat uit de invloed van *vrienden*. Vrienden spelen een belangrijke rol wanneer het gaat om gender-stereotiep gedrag. Vrienden die meer traditionele genderrolverwachtingen hebben, zullen gender-atypische gedragingen (meisjes in bètastudies) sneller afkeuren dan genderstereotiepe gedragingen (jongens in bètastudies). De traditionele genderrolverwachtingen van vrienden kunnen zodoende genderstereotiepe studierichtingkeuzes bevorderen. Hoewel dit vaak als verklaring wordt gegeven voor waarom jongens en meisjes verschillende studierichtingen kiezen, wordt het in onderhavig onderzoek daadwerkelijk getest. Ook wordt de invloed van gendercompositie van de vriendengroep onderzocht. Vriendengroepen van jongeren zijn vaak gesegregeerd naar sekse: jongens zijn vaker bevriend met jongens en meisjes met meisjes. Onderzoeksresultaten zijn niet eenduidig of dit sekseverschillen in studiekeuzes vergroot of verkleint. Deze dissertatie onderzoekt hoe de genderrolverwachtingen van vrienden en de gendercompositie van de vriendengroep een rol spelen in de studierichtingkeuzes van jongens en meisjes.

Genderrolsocialisatietheorie en hulpbronnentheorie

In de vier empirische hoofdstukken van dit proefschrift wordt gebruik gemaakt van de genderrolsocialisatietheorie. De *genderrolsocialisatietheorie* voorspelt dat jongens en meisjes *verschillende* studiekeuzes maken omdat ze verwachtingen over "correct" mannengedrag of vrouwengedrag internaliseren in hun eigen genderideologie (hoofdstuk 2). Daarbij leren ze wat "correct" mannen- of vrouwengedrag is van hun ouders (hoofdstuk 3), broer of zus (hoofdstuk 4), of vrienden (hoofdstuk 5). In twee hoofdstukken wordt deze theorie afgezet tegen de *hulpbronnentheorie*, die voorspelt dat jongens en meisjes *dezelfde* richtingen kiezen als hun ouders (hoofdstuk 3) of oudere broer of zus (hoofdstuk 4) omdat ze gebruik maken van de hulpbronnen (kennis, vaardigheden en

aspiraties) die het beroep van ouders of de studie van de oudere broer of zus met zich meebrengt. Door deze twee theorieën tegen elkaar af te zetten, krijgen we een beter beeld van de manier waarop de sociale omgeving de studiekeuzes van jongeren beïnvloedt.

Nederlands onderwijssysteem

Het Nederlandse onderwijsstelsel is uniek en biedt de mogelijkheid om op twee manieren meer inzicht te verkrijgen in de studiekeuzes van jongeren. Ten eerste kiezen jongeren in Nederland een studierichting op de middelbare school (profielkeuzes) *en* een studierichting na de middelbare school. Zodoende kunnen studiekeuzes worden onderzocht die adolescenten op relatief jonge leeftijd maken (14 of 15 jaar), als ook studiekeuzes op oudere leeftijd (16, 17 of 18). Het is belangrijk dat we meer te weten komen over waarom jongens en meisjes op jonge leeftijd al andere richtingen kiezen, vooral gezien het feit dat profielkeuzes restrictief kunnen werken en bepalend zijn voor de verdere studieloopbaan van jongeren. Zo verleent het profiel cultuur en maatschappij bijvoorbeeld geen toegang tot geneeskunde. Vergeleken met andere landen (bijvoorbeeld Zweden) is het in Nederland relatief moeilijk om deze keuze ongedaan te maken (met cultuur en maatschappij toch geneeskunde te gaan studeren). Ten tweede, studenten in Nederland kiezen hun studierichting op verschillende niveaus (het middelbaar beroepsonderwijs, het hoger beroepsonderwijs en de universiteit). In veel andere landen worden studierichtingen alleen gekozen na de middelbare school en/of in hoger onderwijs (bijvoorbeeld Amerika). Zo kunnen we de studiekeuzes van jongeren onderzoeken op alle niveaus in plaats van alleen in het hoger onderwijs.

Data

De data die gebruikt worden in dit proefschrift zijn de eerste en de tweede ronde van de Children of Immigrants Longitudinal Survey in Four European Countries (CILS4EU) en de vierde en vijfde ronde uit het vervolg van dit project in Nederland: Children of Immigrants Longitudinal Survey in The Netherlands (CILS4NL).

Met deze data worden de profielkeuzes (hoofdstuk 2) en de keuzes van jongeren *na* de middelbare school onderzocht (hoofdstuk 3, 4, 5). De data bevatten gegevens over genderrolverwachtingen van jongeren en cognitieve testen, zodat het effect van genderrolverwachtingen op studierichtingkeuzes getoetst kan worden ongeacht hoe goed jongeren zijn in bepaalde vakken. Tenslotte kan er op een unieke manier gekeken worden naar de invloed van het gezin en vrienden, omdat ouders en vrienden ook hebben meegedaan.

Samenvatting per hoofdstuk

Hoofdstuk 2: De invloed van geïnternaliseerde genderrolverwachtingen op de profielkeuzes van jongens en meisjes

In dit hoofdstuk wordt de invloed van geïnternaliseerde genderrolverwachtingen van adolescenten onderzocht, ook wel genderideologie genoemd. Een genderideologie bestaat uit opvattingen die iemand heeft ten aanzien van wat "correct" gedrag is voor mannen en vrouwen. Dit kan gevolgen hebben voor profielkeuzes omdat het invloed heeft op hoe goed jongens en meisjes denken dat ze zijn in bepaalde vakken (*competentie-overtuigingen*), wat jongeren belangrijk vinden in een toekomstige baan (*beroepswaarden*), en welke vakken ze leuk vinden (*lievelingsvakken*). Een traditionele genderideologie dicteert dat bètavakken iets zijn voor jongens en alfavakken iets voor meisjes. Dit kan ertoe leiden dat meisjes hun competenties in wiskunde onderschatten en in talen overschatten,

terwijl jongens hun competenties in wiskunde overschatten en in talen onderschatten. Traditionele genderrolverwachtingen leiden ook tot de verwachting dat jongens inkomen belangrijk vinden in een toekomstige baan, terwijl meisjes het helpen van mensen belangrijk vinden. Als laatste leidt een traditionele genderideologie ertoe dat jongens genderstereotiepe mannelijke vakken (wiskunde, natuurkunde etc.) leuker vinden en meisjes genderstereotiepe vrouwelijke vakken (frans, maatschappijleer etc.). Profielkeuzes worden vaak gemaakt op basis van competentieovertuigingen, beroepswaarden en lievelingsvakken. Een traditionele genderideologie leidt zodoende tot meer traditionele studiekeuzes.

De data werden met multinomiale padmodellen geanalyseerd. Resultaten laten zien dat jongens met een traditionele gender ideologie meer waarde hechten aan een hoog inkomen in een toekomstige baan en minder aan het helpen van mensen. Ook hebben jongens met een traditionele genderideologie meer mannelijke lievelingsvakken. Deze traditionele beroepswaarden en lievelingsvakken zorgen er vervolgens voor dat jongens het profiel *natuur en techniek* kiezen en niet het profiel *natuur en gezondheid* en *cultuur en maatschappij*. Een traditionele genderideologie beïnvloedt de competentieovertuigingen van jongens niet en leidt niet tot genderstereotiepe profielkeuzes voor meisjes. Genderideologie beïnvloedt dus de profielkeuzes van jongens. Jongens kiezen bepaalde profielen niet vanwege normatieve opvattingen over wat "correct" jongensgedrag is. Aangezien meisjes niet worden tegengehouden door genderrolverwachtingen, impliceren de resultaten dat het makkelijker is voor meisjes om een genderstereotiepe mannelijke keuze te maken, terwijl een genderstereotiepe vrouwelijke keuze minder wordt geaccepteerd voor jongens.

Hoofdstuk 3: Intergenerationele overdracht van genderongelijkheid. Hoe ouders genderongelijkheid in studierichtingen beïnvloeden

In dit hoofdstuk wordt de invloed van niet-hiërarchische beroepskenmerken van ouders op de studiekeuze van hun kinderen na de middelbare school onderzocht. Er wordt specifiek gekeken naar de invloed van het beroepsveld van vader en moeder op de studierichtingkeuze van hun kind. Daarbij wordt onderzocht hoe deze invloed verschilt voor jongeren die bij beide ouders wonen en jongeren die bij hun moeder wonen.

Er worden twee theorieën tegen elkaar afgezet. De genderrolsocialisatietheorie voorspelt dat het beroep van ouders een voorbeeld kan zijn voor hoe jongens en meisjes zich horen te gedragen. Jongens en meisjes leren zodoende van het beroep van hun ouders wat een "gepaste" studierichting is voor hun sekse. Als zij zich hiernaar gaan gedragen, leidt een genderstereotiep beroep van ouders tot een genderstereotiepe studiekeuze voor het kind. Genderrolsocialisatietheorie stelt dat het waarschijnlijker is dat dochters dit leren van hun moeder en zoons van hun vader. De alternatieve theorie is de hulpbronnentheorie. Deze theorie stelt dat ouders bepaalde hulpbronnen (bijvoorbeeld vaardigheden, informatie en aspiraties) uit hun beroepsveld overdragen aan hun kinderen. Als jongeren deze beroepsspecifieke hulpbronnen gebruiken in het maken van hun studiekeuzes, dan leidt dit tot de verwachting dat jongeren dezelfde studierichting kiezen als het beroepsveld van hun ouders. Volgens deze theorie heeft de ouder met de hoogste beroepsstatus de meeste invloed.

De data werden geanalyseerd aan de hand van padmodellen en de resultaten laten zien dat het beroepsveld van moeder, niet van vader, invloedrijk is. Conform de genderrolsocialisatietheorie, zorgen moeders met een meer genderstereotiep vrouwelijk beroep dat

jongens en meisjes meer genderstereotiepe studierichtingen kiezen. Haar invloed is niet heel groot, maar het betekent wel dat er minder gendersegregatie in studierichtingen zou zijn als er meer moeders in genderstereotiepe mannelijke beroepen zouden zitten. In tegenspraak met de gendersocialisatietheorie heeft moeder niet alleen invloed op haar dochter, maar ook op haar zoon. Er wordt geen bevestiging gevonden voor directe overdracht van hulpbronnen (hulpbronnentheorie). Ook verschilt de invloed van ouders niet voor kinderen die bij twee ouders wonen en kinderen die alleen bij hun moeder wonen. Een eerste conclusie is dat niet-hiërarchische kenmerken van ouders (beroepsveld) belangrijk zijn voor de studierichtingkeuzes van hun kinderen. Een tweede conclusie is dat naast de invloed van vader, ook de invloed van moeder meegenomen zou moeten worden in onderzoek naar de invloed van ouders op de studierichtingkeuzes van hun kind. Een laatste conclusie is dat er in dit hoofdstuk geen bewijs wordt gevonden dat familiestructuur bijdraagt aan (gender)ongelijkheid in studiekeuzes. Hoewel familiestructuur invloed heeft op schoolprestaties of voortijdige schoolverlating, beïnvloedt het geen (sekseverschillen in) studiekeuzes.

Hoofdstuk 4: De invloed van broers en zussen in studierichtingkeuzes

Dit hoofdstuk onderzoekt de rol van oudere broers of zussen in de studiekeuzes van hun jongere broer of zus. Wederom worden de genderrolsocialisatietheorie en hulpbronnentheorie tegen elkaar afgezet. Volgens de genderrolsocialisatietheorie leren jongere broers en zussen wat "correct" gedrag is voor jongens en meisjes van het gedrag van hun oudere broer of zus. Specifiek de studierichting van oudere broers en zussen kan een voorbeeld zijn van wat een "correcte" studierichting is voor iemands sekse. Als jongere broers en zussen zich hiernaar gaan gedragen, dan zullen jongere broers en zussen vaker een genderstereotiepe studiekeuze maken als oudere broer en zus een genderstereotiepe studierichting heeft gekozen. In andere woorden, oudere broers en zussen bevorderen sekseverschillen in studierichtingkeuzes. Volgens de genderrolsocialisatietheorie is het waarschijnlijk dat een oudere zus vooral invloed heeft op haar jongere zus en een oudere broer vooral op zijn jongere broer. Hulpbronnentheorie voorspelt dat jongere broers of zussen dezelfde studierichtingen kiezen als de studierichting van oudere broers of zussen omdat ze gebruik maken van de hulpbronnen (kennis, vaardigheden en aspiraties) die het studieveld van de oudere broer of zus met zich meebrengt. Deze invloed zou volgens de hulpbronnentheorie sterker zijn wanneer de oudere broer en zus meer kennis en vaardigheden heeft, wat vaker zo is als ze ouder zijn (meer leeftijdsverschil tussen broers en zussen) of hoger zijn opgeleid.

De data werden geanalyseerd met conditioneellogistische analyses. De resultaten laten zien dat, conform de hulpbronnentheorie, de studierichting van oudere broer en zus dezelfde studierichtingkeuze bevordert voor jongere broer en zus. Deze invloed was aanwezig naast die van ouders en werd niet beïnvloed door verschil in leeftijd of opleidingsniveau. Het maakt ook niet uit welke studie de oudere broer of zus gekozen had, wat betekent dat hun kennis en vaardigheden in een bepaalde studie (bijvoorbeeld medicijnen) niet bruikbaarder zijn dan in andere studies (bijvoorbeeld talen). De resultaten ondersteunen de genderrolsocialisatietheorie niet. Wel wordt er gevonden dat jongere broers dezelfde studierichting kiezen als het beroepsveld van vader. Een belangrijke conclusie uit dit hoofdstuk is dat oudere broers en zussen niet bijdragen aan genderongelijkheid in studierichtingen. Het feit dat broers en zussen geneigd zijn dezelfde

studierichtingen te kiezen heeft als gevolg dat interventies die gericht zijn om jongeren in een bepaalde studierichting te krijgen (bijvoorbeeld meer mensen in de ICT), een indirect effect hebben op de jongere broers en zussen van deze studenten, maar dat het niet leidt tot meer of minder gendersegregatie in studierichtingen.

Hoofdstuk 5: De invloed van vrienden op het kiezen van bètawetenschappelijke richtingen.
Hoofdstuk 5 onderzoekt de invloed van vrienden op sekseverschillen in studierichtingkeuzes. Er wordt specifiek gekeken naar het belang van traditionele genderrolopvattingen van vrienden en de gendercompositie van de vriendengroep.

Traditionele genderrolverwachtingen schrijven voor dat bètawetenschappen iets voor jongens zijn en niet iets voor meisjes. Jongeren gedragen zich volgens de normen in hun vriendengroep uit angst om afgewezen te worden. Als adolescenten vrienden hebben met sterkere traditionele genderrolverwachtingen, dan wordt de kans groter dat zij zich volgens deze genderrolverwachtingen gaan gedragen. Vriendengroepen die meer traditionele genderrolopvattingen aanhangen, zorgen dan voor meer bètawetenschappelijke studiekeuzes voor jongens, en juist minder bètawetenschappelijke studiekeuzes voor meisjes.

De gendercompositie van een vriendengroep kan op twee manieren invloed hebben op de studiekeuze van jongeren. Aan de ene kant, als jongens en meisjes meer vrienden hebben van hetzelfde geslacht, dan kan dit de druk om zich aan genderrolverwachtingen te conformeren vergroten. Met meer meisjes (jongens) in de omgeving kan het moeilijker zijn om bètawetenschappen (talen) te kiezen omdat vrienden van hetzelfde geslacht dit zouden afkeuren. Meer vrienden van hetzelfde geslacht vergroot dan genderstereotiepe studierichtingkeuzes. Aan de andere kant kan de druk om zich conform genderrolverwachtingen te gedragen juist afnemen wanneer men meer vrienden heeft van hetzelfde geslacht. Hierbij is het argument dat een individu juist minder wordt tegengehouden door het andere geslacht om gender-atypische interesses en activiteiten te ontplooien. In een omgeving met alleen maar meisjes wordt niet bevestigd dat bètawetenschappen specifiek iets voor jongens is en kiezen meisjes dus vaker bètawetenschappen. In deze redenering leidt een vriendengroep met meer vrienden van hetzelfde geslacht tot minder genderstereotiepe studiekeuzes.

De data werden geanalyseerd aan de hand van multinomiaallogistische regressieanalyses. De resultaten tonen aan dat traditionele genderrolverwachtingen van vrienden, meisjes tegenhouden in het kiezen van bètawetenschappelijke studierichtingen, omdat "dit niet iets voor hen zou zijn". Voor jongens zijn de gendernormen van vrienden minder belangrijk, maar wanneer jongens meer vrienden hebben van hetzelfde geslacht, kiezen ze vaker voor een bètawetenschappelijke richting. Gezien hun bètawetenschappelijke keuze niet verklaard wordt door de druk om zich aan genderrolverwachtingen te conformeren, is een alternatieve verklaring voor dit effect dat jongens met elkaar meer bètawetenschappelijke activiteiten en interesses delen, en zodoende sneller bètawetenschappelijke richtingen kiezen.

Conclusies en verder onderzoek

Conclusies
Deze dissertatie laat zien dat de sociale omgeving van adolescenten belangrijk is voor hun studierichtingkeuzes. De relatie is complex doordat verschillende aspecten van de sociale omgeving

belangrijk zijn voor jongens of meisjes. Ook kan er op basis van de bevindingen geconcludeerd worden dat genderrolsocialisatietheorie en hulpbronnentheorie studiekeuzes deels verklaren, maar dat hun meerwaarde afhankelijk is van naar welk aspect van de sociale omgeving er gekeken wordt. Genderrolsocialisatietheorie verklaart hoe geïnternaliseerde genderrolverwachtingen voor jongens, genderrolverwachtingen van vrienden voor meisjes, en het beroepsveld van moeder sekseverschillen in studiekeuzes bevorderen. De hulpbronnentheorie verklaart de studiekeuzes van jongeren wanneer het gaat om het effect van het beroepsveld van vader op zoon en van oudere broer en zus op jongere broer en zus. Het beroepsveld van vader en de studierichting van oudere broer of zus leidt tot dezelfde richtingkeuzes voor hun zoon of jongere broer of zus, wat betekent dat vaders, broers en zussen niet bijdragen aan genderongelijkheid in studierichtingen.

Deze dissertatie toont aan dat sociale verwachtingen over wat "correct" jongens- of meisjesgedrag is, de studieloopbaan van jongeren beïnvloedt, maar voor jongens zijn het hun eigen verwachtingen en voor meisjes die van hun vrienden. De gevolgen van genderrolverwachtingen lijken echter groter voor meisjes dan voor jongens. Genderrolverwachtingen zorgen dat jongens het profiel natuur en techniek kiezen en niet de profielen cultuur en maatschappij en natuur en gezondheid. Potentieel hebben ze daarmee toegang tot alle studierichtingen in het vervolgonderwijs en kunnen ze dus een beslissing op basis van genderrolverwachtingen nog ongedaan maken. Meisjes kiezen door de genderrolverwachtingen van vrienden minder vaak voor een bètaopleiding na de middelbare school. Deze keuze is meer bepalend voor een toekomstige carrière en dus hebben genderrolverwachtingen meer impact op de carrière van meisjes. Ongeacht de verschillende potentiële gevolgen, is het niet wenselijk dat adolescenten keuzes maken op basis van sociale verwachtingen. De maatschappij en de adolescenten zelf zouden meer baat hebben bij studiekeuzes op basis van potenties, preferenties en competenties. Zo krijgen we getalenteerde individuen in de juiste banen.

Vaders en moeders hebben een verschillende invloed op hun kinderen. Een moeder met een genderstereotiep beroep bevordert genderstereotiepe studiekeuzes voor haar zoon of dochter (genderrolsocialisatietheorie). Het beroepsveld van vader genereert dezelfde studierichtingkeuzes voor zijn zoon (hulpbronnentheorie). Dit impliceert dat moeders haar kinderen (genderspecifieke) waarden leren, terwijl vaders hulpbronnen overdragen naar de volgende generatie. Hoewel voorgaand onderzoek zich voornamelijk richtte op de invloed van vaders, kunnen moeders en vaders dus een verschillende invloed hebben op de studierichtingkeuzes van hun kinderen. Dit benadrukt nogmaals dat beide ouders meegenomen moeten worden in onderzoek naar sekseverschillen in studiekeuzes van jongeren.

Voorlopige conclusies die verder onderzoek behoeven

Dit onderzoek laat zien dat verschillende actoren uit de sociale omgeving van adolescenten belangrijk zijn, maar heeft de relatieve invloed van deze actoren niet kunnen testen. Een belangrijke vraag voor vervolgonderzoek is dan ook welke actoren, onder welke omstandigheden, meer invloed hebben. Vooral gezien vaders, broers en zussen geen sekseverschillen in studiekeuzes genereren, maar moeders en vrienden wel, zou deze vraag in verdere studies aandacht behoeven.

Deze dissertatie concludeert dat het *gedrag* van ouders (beroepsveld) en broers en zussen (studierichting) invloed heeft op de studierichtingkeuze van jongeren, en dat de *attitudes* (genderrolverwachtingen) van vrienden invloedrijk zijn. Een suggestie voor verder onderzoek is

om de invloed van attitudes te vergelijken met de invloed van gedrag. Alleen voor ouders kon er een vergelijking gemaakt worden tussen gedrag (beroepsveld) en attitudes (genderrolverwachting), waaruit bleek dat gedrag meer invloed had. Een verklaring hiervoor is dat gedrag, meer dan attitudes, beperkt wordt door culturele normen over "correct" mannen- en vrouwengedrag. De sociale omgeving keurt gender-atypische gedragingen sneller af dan gender-atypische attituden. Oftewel, het is makkelijker om liberale ideeën te hebben over "correct" mannen- of vrouwengedrag (mannen in de zorg is prima), maar daadwerkelijk een gender-atypisch beroep kiezen (mannelijke verpleegkundige) wordt sneller afgekeurd door de omgeving. Als beroepen derhalve meer genderstereotiep zijn dan attitudes, dan is het te verwachten dat deze ook meer invloed hebben. Verder onderzoek zou moeten uitwijzen of het relatieve belang van gedrag en attituden gegeneraliseerd kan worden naar andere personen dan de ouders.

De resultaten suggereren ook dat genderrolverwachtingen een andere rol spelen voor jongens en meisjes in profielkeuzes dan in studiekeuzes na de middelbare school. Genderrolverwachtingen bevorderen genderstereotiepe mannelijke profielkeuzes voor jongens *op* de middelbare school, maar ze belemmeren meisjes in het kiezen van genderstereotiepe mannelijke studies *na* de middelbare school. Hoewel onderzoek aantoont dat het uitstellen van studiekeuzes het effect van genderrolverwachtingen zou verminderen, blijkt uit de resultaten van dit proefschrift dat genderrolverwachtingen geen onomkeerbare invloed hebben op de profielkeuze van jongens en dat ze de profielkeuze van meisjes helemaal niet beïnvloeden. Zodoende kan geconcludeerd worden dat jongeren in Nederland niet veel baat hebben bij het uitstellen van deze keuzes. Dit onderzoek heeft echter niet de invloed van (de genderrolverwachtingen van) ouders, broers, zussen of vrienden op profielkeuzes kunnen testen. Vervolgonderzoek zou zich hierop kunnen richten om meer zicht te krijgen op hoe genderrolverwachtingen studiekeuzes van adolescenten op jonge leeftijd beïnvloeden.

Dit onderzoek richtte zich op niet-hiërarchische kenmerken, zoals beroepsveld (van ouders) of studierichting (van jongeren), maar deze kunnen verweven zijn met hiërarchische kenmerken, zoals opleidingsniveau en beroepsstatus. Onderzoek stelt bijvoorbeeld dat kinderen uit laagopgeleide gezinnen vaker genderstereotiepe studierichtingkeuzes maken omdat deze gezinnen vaker traditionele genderrolopvattingen hebben. Daarentegen hebben hoogopgeleide ouders vaker een baan met een hogere beroepsstatus, wat ertoe kan leiden dat hun kinderen meer prestigieuze – genderstereotiep mannelijke – studierichtingen kiezen. De resultaten van deze studie ondersteunen beide redeneringen, maar geven weer dat een onderscheid tussen vaders en moeders hierin belangrijk is. Voor kinderen van hoogopgeleide ouders en kinderen die op HAVO/VWO zitten, is het beroepsveld van vader invloedrijk en bevordert dit geen genderstereotiepe keuzes. Kinderen van laagopgeleide ouders worden door hun moeder gesocialiseerd naar meer genderstereotiepe studierichtingen. Meer onderzoek zou zich kunnen toespitsen op hoe hiërarchische kenmerken en niet-hiërarchische kenmerken samen studiekeuzes beïnvloeden, waarbij de specifieke rol van vader en moeder in acht genomen wordt.

Praktische implicaties

De praktische implicaties van dit proefschrift zijn niet alleen gebaseerd op de bevindingen van dit proefschrift, maar ook op een expertmeeting over sekseverschillen in studierichtingkeuzes in

Oxford (september, 2016). Deze bijeenkomst werd bijgewoond door 14 experts uit verschillende landen en had als doel de resultaten en implicaties van dit proefschrift te bespreken.

Genderrolverwachtingen zijn invloedrijk voor studierichtingkeuzes en uit deze bijeenkomst werd duidelijk dat Nederland niet het enige land is waar dit het geval is. Een manier om sekseverschillen in studiekeuzes te verminderen, is om deze normatieve ideeën over wat typisch mannelijk of vrouwelijk is aan te pakken. Een mogelijkheid die genoemd werd, is het gebruik van rolmodellen. We weten al dat meisjes die vrouwen met een technisch beroep ontmoeten (bijvoorbeeld bij lezingen, speeddates of meeloopdagen) meer geneigd zijn om een technische opleiding te gaan doen. Aangezien genderrolverwachtingen ook jongens tegenhouden in het kiezen van vrouwelijke studies, zouden voor jongens rolmodellen in stereotiepe vrouwelijke beroepen minstens zo belangrijk kunnen zijn. Een gastlezing van een mannelijke psycholoog, speeddates met een mannelijke verpleegkundige of meeloopdagen voor jongens in vrouwelijke beroepen zijn voorbeelden van interventies die het idee tegen kunnen gaan dat deze richtingen niets voor hen zouden zijn. De experts maakten echter een belangrijke kanttekening bij deze interventies waar nog weinig onderzoek naar gedaan is, namelijk dat het benadrukken van gender-atypische keuzes (mannelijke verpleegkundige, vrouwelijke scheikundige), juist genderrolbevestigend kan werken. Als er een dag voor *alleen* meisjes wordt georganiseerd in een scheikundelaboratorium, dan kan dit juist bevestigen dat dit niet iets voor meisjes zou zijn. Meer onderzoek zou zich moeten richten op de potentiële rolbevestigende consequenties van zulke interventies.

Bewustwording bij ouders is een andere manier om sekseverschillen in studiekeuzes te reduceren. Ouders hebben een belangrijke invloed op de studiekeuze van hun kinderen en door hen bewust te maken van het feit dat hun traditionele genderrolverwachtingen en genderstereotiepe gedragingen invloed hebben op de studiekeuze van hun kinderen, zou bewustwording sekseverschillen in studiekeuzes kunnen tegengaan. De experts gaven aan dat ouders bijvoorbeeld vaak nog steeds denken dat meisjes niet geschikt zijn voor de bètawetenschappen omdat ze niet goed zouden zijn in wiskunde. Ouders er over informeren dat vaardigheden en competenties niet sekse-specifiek zijn, zou hun opvattingen kunnen veranderen. Een andere manier om hetzelfde te bereiken is door ouders te informeren over de inhoud en (carrière)mogelijkheden van bètastudies. Het landelijk expertisebureau meisjes/vrouwen en bèta/techniek (VHTO) concludeert in een trendanalyse in 2011 dat ouders vaak geen realistisch beeld hebben van bèta- en technische opleidingen en dat ze weinig kennis hebben over wat bèta/technische carrières te bieden hebben. Informatie over de voordelen van bètacarrières – bijvoorbeeld baanzekerheid of goed inkomen – zou dit kunnen veranderen. Folders of ouderavonden (op school) zijn bijvoorbeeld manieren om ouders te bereiken.

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Curriculum Vitae

Maaike van der Vleuten was born in Maastricht, the Netherlands, on January 27, 1989. She completed her Bachelor 's degree in interdisciplinary social sciences with an additional honors program and a minor in statistics (2010). After her bachelor, she graduated cum laude from the research master program Sociology and Social Research at Utrecht University (2013). In September 2013, Maaike started working as a PhD candidate at the Interuniversity Center of Social Science Theory and Methodology (ICS) in Utrecht and wrote this dissertation under the supervision of Eva Jaspers, Ineke Maas and Tanja van der Lippe. As part of her PhD training, she conducted a three-month research visit in 2016 at the University of Amsterdam (UvA), the Netherlands. As a result, chapter 5 is a collaboration with dr. Stephanie Steinmetz prof. dr. Herman van de Werfhorst, both affiliated with the UvA. At Utrecht University, Maaike taught in the bachelor sociology and the postgraduate course Sociology and Social Research. Moreover, she organized an expert meeting on gender differences in fields of study in Nuffield University Oxford. In addition, Maaike co-coordinated the fourth, fifth and sixth wave data collection of the Dutch part of the 'Children of Immigrants Longitudinal Survey in Four European Countries' project (CILS4EU) between 2013 and 2016. As of August 2017, she works as an assistant professor at the Sociology department at Radboud University Nijmegen.

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