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Gender Segregation across Fields of Study in Post-Secondary Education: Trends and Social Differentials

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Abstract

This article examines whether gender segregation across fields of study in higher education varies between children coming from different socio-economic groups, and changed across time. A possible intersectionality between gender and socio-economic background has hardly been addressed thus far. Using Dutch survey data covering cohorts born between the 1930s and 1980s, I study trends in gender segregation across seven broad fields in post-secondary education, and examine whether gender segregation is different across parental educational levels. Segregation is found to diminish over time, although the trend has stalled. Segregation is, in some fields, less strong among children of higher social origins, both because higher-socio-economic status (SES) daughters are more likely to enrol in the science, technology, engineering, and math fields, and because higher-SES sons are more likely to enrol in health than their lower-SES counterparts. Tentative explanations for these findings are presented that relate to stronger gender-typical socialization in lower-SES families, and potential differential abilities in mathematics and languages across SES groups.

Introduction

Despite the tendency towards equalization of educational opportunities between men and women, a process during which female disadvantage now has turned into female advantage in educational achievement and attainment, gender segregation across fields of study/college majors is more resistant to change (Barone, 2011; Bradley, 2000). Women tend to choose fields of study that are usually less attractive in terms of labour market prospects than men do, prefer humanistic and social fields of study over engineering and the sciences, and they continue to do so despite their growing participation in higher education. Researchers have concluded that gender-typical choice patterns cannot be explained by a rational choice framework where choices are solely guided by the probability of success in different disciplines (Jonsson, 1999; Riegle-Crumb et al., 2012; Van De Werfhorst et al., 2003). Rather, human interactions, national institutions, and value systems seem to affect the norms that men and women develop concerning their roles in society, which affects their attitudes towards mathematics and related fields (Charles and Bradley, 2009; Gunderson et al., 2012). Even if men and women would have similar achievements in mathematics courses, socialization into traditional gender roles keeps women from choosing the sciences.

We study both the changes and the differences between social groups under one theoretical umbrella, to examine

(i) to what extent gender segregation across fields of study has changed during the past decades, and (ii) to what extent gender segregation across fields of study differs between children of different socio-economic status (SES) backgrounds. Moreover, we can trace whether the social gradient in segregation, and the trend towards desegregation, is asymmetric, with women more likely to enter male-dominated fields than the other way around (England, 2010). These descriptive questions, answered with data from the Netherlands, provide empirical evidence relevant for both economic and sociological approaches to gender segregation, perspectives that each may have its strength but in isolation only tell part of the story (Stockdale and Nadler, 2013). Importantly, the socialization and rational choice approaches can be usefully integrated in the study of social gradients and time trends in gender segregation.

Gender Segregation in Education: Theoretical Background

Socialization as Diversion from Rational Choices

Studies on gender differences in choice of field of study fail to fully account for gender segregation by gender differences in mathematics achievement or comparative advantage in mathematics versus languages (Ayalon, 2003; Jonsson, 1999; Morgan et al., 2013; Riegle-Crumb et al., 2012). Also the theory by Polachek (1978) that women prefer academic disciplines that accommodate their expected intermittency from work due to family formation—thereby maximizing their lifetime earnings—has been refuted based on an analysis of lifetime earnings (England et al., 1988). Apparently, there is 'limited utility of theories focusing on gender differences in skills and abilities' (Riegle-Crumb et al., 2012: p. 1050). In addition, even to the extent that gendered preferences or career expectations would drive choice of field of study, we would need a structural and constructivist account of gender to explain the emergence of such preferences through processes of socialization. Through daily interaction between teachers, parents, and students, gender relations are confirmed and reinforced (Ridgeway and Smith-Lovin, 1999; Gunderson et al., 2012). Socialization, then, affects attitudes and beliefs about mathematics (Good et al., 2012; Parker et al., 2014), and gendered preferences concerning labour market and family involvements (Barone, 2011; Busch-Heizmann, 2015; DiPrete and Buchmann, 2013; Mann and DiPrete, 2013; Shauman and Xie, 2003). These processes likely affect the choice of field of study in post-secondary education.

Socialization and Social Background

A common perspective in gender studies is that gender matters differently across different contexts. Gender interacts with other socio-demographic characteristics such as ethnicity or social class. The literature refers to these interactions as *intersectionalities* of gender with other social categories (Crenshaw, 1991; McCall, 2005). The intersectionality between gender and social background has not yet been addressed in the context of segregation in post-secondary education. Enabled by the multi-interpretable character of the concept (Davis, 2008), we approach intersectionality in terms of gender differences in field choice in post-secondary education that are dependent on context, where context is defined by SES and cohort.

Following the intersectionality theory, gender segregation across fields of study may be different across SES groups. Gender-typical norms are more likely to emerge in interactional contexts where the division of labour is gendered, as is more often the case in lower-educated families in many countries (Davis and Greenstein, 2004). 'Doing gender' as a social constructivist account of gender identity, is, in other words, context-specific, and contexts can be defined both by family SES and time (West and Zimmerman, 1987). A few studies point to the intergenerational transmission of gender role attitudes about family and work, especially among mothers and daughters (Burt and Scott, 2002; Farré and Vella, 2013; Moen et al., 1997). Parental educational attainment appears to be positively related to gender-egalitarian norms (Farré and Vella, 2013). Norms about work and family life are thus plausibly less gender-typical among children from more advantaged social backgrounds, which makes it more plausible that children from well-educated families choose fields that are atypical for one's own gender more often than children of less advantaged social backgrounds. Women from higher social origins can then be expected to be more likely to enrol in science, technology, engineering, and math (STEM) fields than women from lower social origins, whereas men would be more likely to enrol, in healthcare, teacher education, and the humanities. As the general *intersectionality hypothesis*, we therefore expect that gender segregation across fields of study is more prevalent among children of disadvantaged social backgrounds compared to children from higher SES backgrounds.

If traditional orientations are predictive of gender-segregated choices of fields of study, it is also likely that gender segregation is declining across time (Brynin and Perales, 2015). Social interactions that are key for the formation of gendered norms are becoming less gendered, given that an increasing share of women

participates in the labour force. However, as England and Li (2006) have demonstrated, desegregation has come to a halt in the United States. A persistent gender essentialist culture, by Charles and Bradley (2009: p. 925) described as 'cultural beliefs in fundamental and innate gender differences', makes that men and women feel entitled to be different and choose gender-typical fields. Moreover, the segregation effects of gender essentialist beliefs are 'intensified [...] by a strong Western cultural emphasis on individual self-expression' (ibid.). The *stalled trend hypothesis* can be formulated holding that as traditional gender ideology has declined (Cotter, Hermsen and Vanneman, 2011), so will gender-typical choice of field of study, although desegregation has stalled due to the persistence (and possibly even stronger effects) of gender essentialist beliefs. Thus, this hypothesis suggests a curvilinear trend in gender segregation across cohorts, first a decline, and then a stalled or reversed trend.

A more specific theory on variations between SES groups and cohorts in the gender segregation of career choices argues that desegregation is asymmetrical (England, 2010). To the extent that desegregation happens, women typically enter more 'male-dominated' areas of life, while men hardly move into female-dominated statuses. Asymmetry reflects the enduring gendered valuation of specific tasks. Women increasingly enter the labour market, while men do not increasingly stay home to raise children or do housework. Also with regard to gender segregation in education, asymmetry may be expected. According to England (2010), women tend to move outside gender-specific fields only if that is needed as a path towards upward mobility. High-SES girls may then be more strongly inclined to choose STEM fields to improve their chances of upward mobility, also facilitated by their higher math ability than lower-SES girls. By contrast, it is unlikely that high-SES men will cross gender boundaries by choosing the social sciences or education, as it will not promote advancement into better labour market positions. Hence, the *asymmetry hypothesis* is that SES differences in segregation, and trends towards desegregation, are asymmetrical. In line with the asymmetry hypothesis, it may therefore be expected that high SES will only moderate segregation to the extent that it covers fields that have a high labour market value. Fields that have persistently good labour market prospects in the Netherlands are health, the sciences, and economics and business (ROA, 2013). Thus, it is expected that high-SES women enrol in male-dominated fields with good prospects (such as the sciences and economics/business), while men may trespass gender boundaries towards the health field, as this is also a valuable field in the labour market. The asymmetry hypothesis would not predict that men move towards female-dominated fields if these fields offer poorer economic prospects, such as teacher education or the humanities.

The Netherlands as an Interesting Testing Ground

The Netherlands offers an interesting and important testing ground for the variability in gender segregation across fields of study across time and across family SES groups. The gender division of labour has historically been very traditional in the Netherlands. Women had one of the lowest labour force participation rates in Organization for Economic Co-operation and Development countries until the 1980s, while participation was among the highest in the 2000s. Yet, part-time work is still very common among Dutch women, and is according to some projections likely to stay (Bosch et al., 2010). A strong motherhood ideology persists, where full-time day care is widely considered to be bad for children (EGGE, 2009; Michel and Mahon, 2002). The division of household work among married couples is similar to that in the United States, which appeared around average in a comparison of 13 countries (Davis and Greenstein, 2004). An increasing share of mothers is therefore working, which likely affects the division of household tasks of their children (Treas and Tai, 2012). The rapidly expanding labour force participation of women may have led to more segregation (Smyth and Steinmetz, 2008), which would make the Netherlands a least likely case to study trends towards desegregation. However, while segregation in the labour market and education are correlated (Smyth and Steinmetz, 2008), it is not self-evident that increased labour force participation of women will have enlarged segregation in education.

Another important reason why the Dutch case is particularly interesting for studying gender segregation in education is that 'horizontal' specializations in education can be chosen at various levels. Choice of field of study (or occupational orientation) can be made at the intermediate vocational schools (upper secondary level), the vocational colleges (nowadays awarding bachelor degrees), and research universities (bachelor and post-graduate degrees).[1] Students choose their specialization already at the registration for college. Figure 1 displays the Dutch educational system. The dotted square illustrates the part of the educational structure that is studied here.

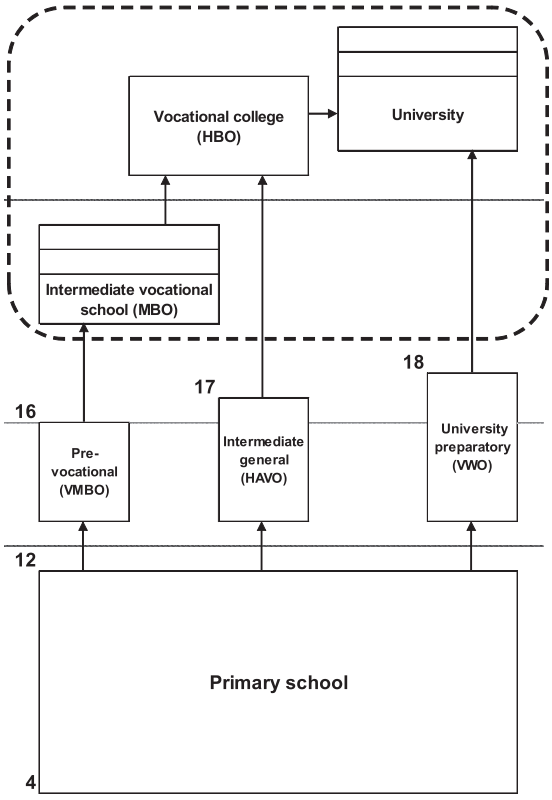

Figure 1. The Dutch educational system and its post-secondary types of education (the figures reflect the typical ages at the transitions)

Data and Variables

Dutch survey data are used to examine the relationship between, on the one hand, gender, social background, and their intersection, and choice of field of study in post-secondary education on the other. This is done using repeated cross-sectional household surveys of the Dutch population collected in the Supplementary Use of Services Research of 1995, 1999, 2003, and 2007 ('Aanvullend Voorzieningengebruik Onderzoek', AVO, in Dutch). A random probability sample of adult household members aged 18–64 years was used, providing us with synthetic birth cohorts born between 1931 and 1989. The AVO data are collected by the Social and Cultural Planning Office residing under the Dutch government, and collected by Statistics Netherlands. Response rates are, in comparison to other Dutch national surveys, high (69, 66, 60, and 63 per cent, respectively, Statistics Netherlands 2008). Throughout the analyses, weights are used to adjust for household composition and possible selective non-response. These weights are developed by Statistics Netherlands to generalize to the whole Dutch non-institutionalized population of the interviewed age group.

The respondents are the 'children' in the design, who have been asked about the level of education of their parents.[2] The field of study of respondents is known for those who have been enrolled in some form of post-secondary education, including post-secondary intermediate vocational school (mbo in Dutch), tertiary vocational college (hbo), and research university. The field is asked of the highest attended type of education, without the requirement of having completed that level of education. Due to this characteristic of the data set, gender and SES differences in enrolment of field are studied, and not necessarily in degree completion in those fields. This may underestimate the gender segregation in finished levels of education if students would be more likely to drop out of gender-atypical fields of study (Mastekaasa and Smeby, 2008).

For the segregation analysis, a distinction is made between seven fields of study: (i) education, (ii) humanities and arts, (iii) STEM (including agriculture), (iv) health, (v) economics (which includes business), (vi) social sciences/law, and (vii) 'other field' (which includes the fields of order and safety, but also undefined fields). Although the categories are sometimes simplified compared to the original data to ensure sufficient numbers in the cells, it should be noted that the data do not permit to distinguish the natural and life sciences from engineering. More fine-grained distinctions among the STEM fields can therefore not be examined, even though that would be relevant from a gender perspective, given the significant rise of women in the life sciences relative to engineering (Mann and DiPrete, 2013).

Parents' educational level is measured by taking the highest completed level of either of the parents, classified in three levels: lower secondary qualification or less, upper secondary (including vocational and general/academic programmes), and tertiary (vocational college or university). In an additional analysis, the levels of both parents are analysed separately.

Birth cohort is categorized in 11 categories (1931–1935 to 1986–1989). Cohort is also entered in its quadratic term to test for the reversal of the trend in desegregation.

Table 1 shows the distributions of all variables used in the analyses.

Results

Descriptive Results

Figure 2 displays dissimilarity indices of gender by the seven broad fields of study, separately within levels of

Table 1. Descriptive statistics of all variables used

Variable	*N*	Per cent
Field of study		
Education	1,734	10.9
Humanities/arts	852	5.3
STEM	3,936	24.7
Health	3,273	20.5
Economics/business	3,485	21.9
Social sciences/law	1,780	11.2
Other	892	5.6
Cohort		
1931–1935	127	0.8
1936–1940	366	2.3
1941–1945	836	5.2
1946–1950	1,395	8.7
1951–1955	1,608	10.1
1956–1960	2,078	13.0
1961–1965	2,315	14.5
1966–1970	2,520	15.8
1971–1975	2,235	14.0
1976–1980	1,318	8.3
1981–1985	831	5.2
1986–1989	323	2.0
Gender		
Men	8,176	51.3
Women	7,776	48.8
Parents' educational level		
≤Lower secondary	8,410	52.7
Upper secondary	3,925	24.6
Tertiary	3,617	22.7
Father's educational level		
≤Lower secondary	9,020	56.5
Upper secondary	3,544	22.2
Tertiary	3,227	20.2
Missing	161	1.0
Mother's educational level		
≤Lower secondary	11,644	73.0
Upper secondary	2,731	17.1
Tertiary	1,425	8.9
Missing	152	1.0
Own educational level		
Intermediate vocational school	5,912	37.1
Vocational college	6,448	40.4
University	3,592	22.5
Total *N*	15,952	100.0

education (Panel A), for three distinct levels of education of the parents (Panel B), and for each field of study (Panel C, excluding the 'other' field). Panel A shows that overall segregation (across all levels) has declined roughly from 0.5 to 0.4 between the 1930s and 1980s birth cohorts. Gender segregation across fields was extremely high for students in the intermediate vocational schools (around 0.65 until the 1950s birth cohorts), declined sharply during the 1960s cohorts, stabilized in the 1970s, and further declined for the 1980s birth cohorts. Segregation across fields was historically much lower in the universities, with the vocational colleges taking an intermediate position. In the vocational colleges, desegregation happened most clearly until the 1950s birth cohorts, after which it more or less stabilized similar to what is found for the United States (England and Li, 2006). After a significant desegregation in the universities until the cohorts born in the 1950s, the trend goes a bit up and down since the 1960s, but that is likely due to relatively small sample sizes.

Panel B shows the results by parental educational level, and in line with our hypothesis, we see lower levels of segregation among children of parents with a tertiary degree compared to children of lower-educated backgrounds. Note however that this could be due to the level of attainment of the students themselves, which will further be tested below.

Panel C shows indices of dissimilarity by fields of study (for each field separately against any other field). We see a marked decline in dissimilarity in the sciences, especially among the last few cohorts (cf. DiPrete and Buchmann, 2013). We also see a decline in segregation in the health field *since* the 1960s, and a declining segregation in the education field *until* the 1960s. Segregation in the economics/business field is low (note that this includes administration and business programmes in the vocational schools), similar to the social sciences, but both fields are becoming slightly more segregated.

Multivariate Models

We start our multivariate models by comparing fit statistics of different multinomial logistic regression models, including different sets of interaction effects between independent variables. Table 2 shows different fit statistics and model comparisons, for each of the post-secondary school types separately (Panels B–D) and for all levels of post-secondary education together (Panel A). In the analyses by type of post-secondary education, the independent variables included in the model are gender (G), social background measured by parents' categorical education (B), and birth cohort in linear and quadratic form (C and C*C). In the pooled analysis a term is added for the level of post-secondary education (E).

In line with our hypotheses, Table 2 shows that the model fit improves if gender segregation is allowed to vary across parental education levels and across birth cohorts (Model 4 improves on Models 1–3). Moreover, we find evidence of a curvilinear relationship between

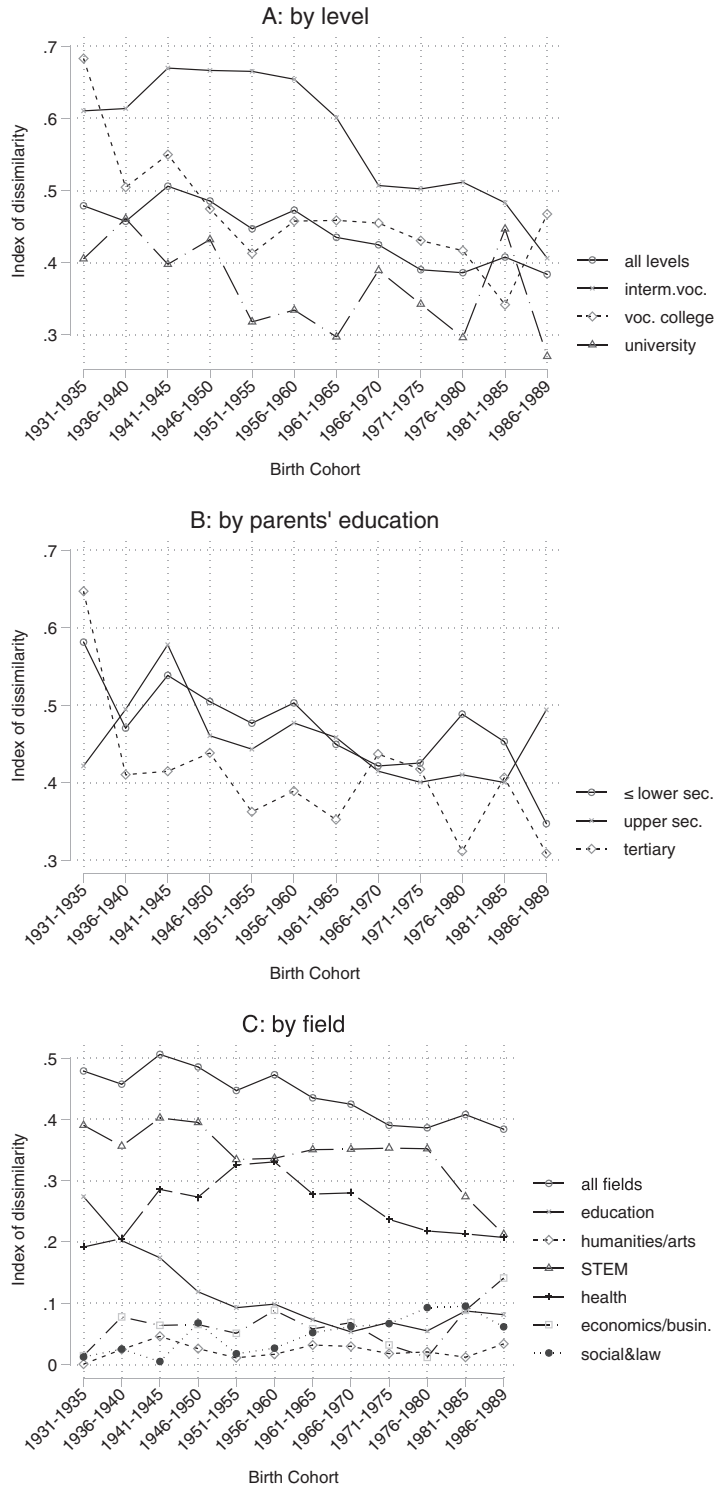

Figure 2. Index of dissimilarity across fields of study, split out by levels of education (**A**), parental education (**B**), and fields of study (**C**)*

cohort and gender differences, in line with the stalled desegregation argument. With the exception of the separate analysis of intermediate vocational schools (Panel D), the three-way interaction between gender, cohort, and social background was not significantly improving the fit of the model. So, even though segregation varies across social backgrounds and across cohorts, we did not find evidence that SES differences in segregation varied across cohorts. In Panel A it furthermore appears that gender segregation varies across levels of post-secondary education (G*E), and that the distribution across levels of education changed across cohorts (C*E). Model 5 of Panel A is considered the preferred model.

In Table 3 the multinomial logit regression coefficients are displayed for Model 5 of Table 2 (Panel A). As a baseline category of the analysis, we took economics and business, a sizeable field with little segregation. Table 3 shows that social background is modestly related to the choice of field. The main effect of parents' education refers to the effect for sons. Children of more highly educated social backgrounds are over-represented in the humanities and arts relative to economics and business. To interpret the strength of the over-representation in the humanities/arts for boys coming from higher-educated backgrounds, we can take the exponentiated coefficient of parental tertiary level ($e^{0.349} = 1.42$), indicating that, relative to children from low-educated parents, the odds of being in the humanities relative to economics and business are multiplied by a factor 1.42. This is in line with other studies that emphasized that cultural capital in the home environment promotes enrolment in the arts and humanities

Table 2. Fit statistics of multinomial logistic regression models

Parameters		Model summary	−2LL	χ^2	*df*	Δ *df*	*P*	Against model
A. All post-secondary levels together (*N*=15,952)								
1	B, G*E, C*E	Only distributions	48,070.6		60			
2	G*B, G*E, C*E	SES differences in segregation	48,008.8	61.8	72	12	0.00	1
3	G*C, B, G*E, C*E	Cohort differences in segregation	48,028.1	42.6	66	6	0.00	1
4	G*C, G*B, G*E, C*E	SES and cohort differences in segregation	47,975.6	33.3	78	6	0.00	2
4				52.5	78	12	0.00	3
5	*G*C*C, G*B, G*E, C*E*	*Cohort curvilinear (stalled desegregation)*	*47,929.8*	*45.8*	*90*	*12*	*0.00*	*4*
6	G*C*B, G*E, C*E	Three-way: SES differences vary by cohort	47,947.6	28	102	24	0.26	4
B. University (*N*=3,592)								
1	G, B, C	Only distributions	11,983.4		24			
2	G*B, C	SES differences in segregation	11,956.3	27.1	36	12	0.01	1
3	G*C, B	Cohort differences in segregation	11,970.4	13	30	6	0.04	1
4	G*C, G*B	SES and cohort differences in segregation	11,940.9	15.4	42	6	0.02	2
4				29.5	42	12	0.00	3
5	*G*C*C, G*B*	*Cohort curvilinear (stalled desegregation)*	*11,916.8*	*24.2*	*54*	*12*	*0.02*	*4*
6	G*C*B	Three-way: SES differences vary by cohort	11,916.8	24.1	66	24	0.46	4
C. Vocational college (*N*=6,448)								
1	G, B, C	Only distributions	21,018.6		24			
2	G*B, C	SES differences in segregation	20,998.3	20.3	36	12	0.06	1
3	G*C, B	Cohort differences in segregation	20,988.1	30.5	30	6	0.00	1
4	G*C, G*B	SES and cohort differences in segregation	20,972.9	25.5	42	6	0.00	2
4				15.2	42	12	0.23	3
5	*G*C*C, G*B*	*Cohort curvilinear (stalled desegregation)*	*20,915.3*	*57.6*	*54*	*12*	*0.00*	*4*
6	G*C*B	Three-way: SES differences vary by cohort	20,950.0	22.9	66	24	0.53	4
D. Intermediate vocational school (*N*=5,912)								
1	G, B, C	Only distributions	14,888.5		24			
2	G*B, C	SES differences in segregation	14,864.6	23.9	36	12	0.02	1
3	G*C, B	Cohort differences in segregation	14,830.7	57.9	30	6	0.00	1
4	G*C, G*B	SES and cohort differences in segregation	14,816.4	48.2	42	6	0.00	2
4				14.2	42	12	0.29	3
5	*G*C*C, G*B*	*Cohort curvilinear (stalled desegregation)*	*14,786.0*	*30.5*	*54*	*12*	*0.00*	*4*
6	G*C*B	Three-way: SES differences vary by cohort	14,775.4	41.1	66	24	0.02	4

Note: B = background (parents' educational level in three categories); G = gender; C = cohort; E = educational level.

(Goyette and Mullen, 2006; Van de Werfhorst and Luijkx, 2010). Also the health and STEM fields are relatively often chosen by children of more advantaged backgrounds. Enrolment in the education field seems to have a curvilinear relationship with parental education. Least likely to enter the field of education are men from medium SES families.

The test of intersectionality between social background and gender is found in the interaction terms between parental education and gender. What is evident from Table 3 is that gender segregation is typically lower for children coming from more highly educated families, at least in some fields. The strong under-representation of women in the science, math, and engineering field is significantly reduced for children of highly educated parents. In the health field, the opposite pattern emerges: the strong over-representation of women is much lower among children of highly educated families (which,

Table 3. Multinomial logistic regression models predicting field enrolment; reference category is economics and business

	Education	Humanities and arts	STEM	Health	Social sciences/ law	Other field
Birth cohort	−0.298**	0.278∼	−0.057	0.030	−0.045	−0.130
	(−3.22)	(1.83)	(−1.05)	(0.34)	(−0.52)	(−1.55)
Birth cohort squared	−0.003	0.004	0.001	−0.004	0.004	0.007
	(−0.39)	(0.51)	(0.24)	(−0.62)	(0.56)	(0.99)
Women	2.736***	2.016**	−2.629***	3.054***	2.002***	−0.444
	(6.91)	(3.17)	(−6.03)	(8.45)	(4.93)	(−0.98)
Women × birth cohort	−0.517***	−0.426**	−0.012	−0.274*	−0.411***	−0.190
	(−4.18)	(−2.81)	(−0.09)	(−2.36)	(−3.36)	(−1.28)
Women × birth cohort squared	0.040***	0.023∼	0.003	0.013	0.028**	0.015
	(3.81)	(1.83)	(0.27)	(1.45)	(2.88)	(1.27)
Parents' educational level (reference: ≤lower secondary)						
Upper secondary	−0.303*	0.337*	0.027	0.172	−0.055	−0.062
	(−2.31)	(2.33)	(0.38)	(1.45)	(−0.49)	(−0.52)
Tertiary	0.090	0.349*	0.064	0.564***	−0.006	0.091
	(0.68)	(2.42)	(0.83)	(4.64)	(−0.05)	(0.65)
Parents' education × gender						
Upper secondary × women	0.380*	−0.104	0.218	−0.144	−0.065	0.059
	(2.26)	(−0.51)	(1.49)	(−1.01)	(−0.42)	(0.31)
Tertiary × women	0.197	0.349∼	0.483**	−0.499**	0.350*	0.108
	(1.14)	(1.75)	(3.08)	(−3.22)	(2.24)	(0.49)
Students' educational level						
Vocational college	2.892***	5.844***	0.324∼	0.295	2.352***	0.226
	(9.90)	(6.12)	(1.94)	(1.44)	(7.82)	(0.96)
University	0.854*	7.035***	−0.102	0.385	3.401***	−0.096
	(2.28)	(7.35)	(−0.52)	(1.52)	(10.86)	(−0.31)
Students' educational level × gender						
Vocational college × women	0.062	0.685	1.092***	0.326*	0.586**	1.144***
	(0.25)	(1.44)	(7.59)	(2.36)	(2.86)	(6.27)
University × women	0.366	1.066*	2.110***	−0.218	0.642**	2.313***
	(1.16)	(2.23)	(12.53)	(−1.28)	(2.97)	(8.75)
Students' educational level × birth cohort						
Vocational college × birth cohort	−0.044	−0.511***	−0.140***	−0.137***	−0.185***	−0.212***
	(−1.05)	(−4.61)	(−5.75)	(−5.12)	(−4.65)	(−5.90)
University × birth cohort	0.018	−0.510***	−0.066*	−0.074*	−0.162***	−0.282***
	(0.31)	(−4.60)	(−2.31)	(−2.10)	(−3.85)	(−5.42)
Constant	−1.421***	−6.784***	1.140***	−1.195***	−2.425***	−0.111
	(−4.29)	(−6.87)	(6.31)	(−4.24)	(−7.08)	(−0.43)

Note: *t* statistics in parentheses.
$\sim P < 0.10$, $^{*}P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$.
Source: AVO 1995–2007 ($N = 15{,}952$).

given the good labour market prospects of the health field (ROA, 2013), could be seen as a falsification of the asymmetry hypothesis). The only social gradient in enrolment in education that was found for men is not found for women. Against the hypothesis of lower segregation among high-SES families is the pattern in the social and legal sciences. The positive effect of gender is stronger for children of tertiary-educated parents, implying stronger segregation among high-SES groups. In line with the asymmetry hypothesis, we do not see men going into those female-dominated fields, even in contexts where gender egalitarianism may be a more prominent norm. The social sciences and law fields, strongly over-represented at the university level, offer opportunities for women to achieve high levels of education without crossing gender boundaries.

Cohort trends in segregation are found in the interaction term between cohort and gender. As is seen in Table 3, most fields have become less gender-segregated across cohorts. For four fields (education, humanities/arts, health, and social sciences/law, all relative to economics), it is seen that the sign of the main effect of gender is opposite to the sign of the interaction term between gender and cohort. We, however, also see that desegregation is stalling, like the trend hypothesis argued. In all cases we see that the sign of the main effect of cohort is opposite to the sign of the quadratic term.

In Table 4 we separate the effects of father's and mother's educational level, with some interesting results. The other coefficients are highly similar to Table 3, so we do not discuss them again. The main effects of father's and mother's education are mostly similar to the effects of parents' education, although father's education is a more important predictor of entering the health field than mother's education. With regard to the interaction effects testing for intersectionality, it appears that the higher-SES origins of students entering the humanities and arts mostly reflect their mother's education. Similarly, also for the social sciences and law, we find a positive interaction of mother's education and gender, implying that segregation into these fields is higher among children of highly educated mothers. This speaks against the general intersectionality theory. With regard to the lower levels of segregation in the STEM fields and health among children of highly educated backgrounds shown in Table 3, we find this expected intersectionality only with regard to mother's education for the STEM fields, and father's education for health. So more highly educated backgrounds make it more likely to trespass gender boundaries, particularly concerning the high education of parents who are under-represented in these fields. This conforms to the socialization argument underlying our intersectionality hypothesis.

Results of multinomial logistic regression models are more easily interpreted in terms of marginal effects. Figure 3 plots the marginal effect of gender for entering the six fields of study (omitting the uninformative category of 'other fields'), by cohort and parental educational level (calculated from the same model as reported in Table 3, note that the ranges on the Y-axes differ). The figure shows that, overall, gender segregation is decreasing. In the field of education, we see that the positive gender effect (i.e. over-representation of women) is decreasing across all cohorts. For cohorts born in the 1980s, women have around 0.05 higher probability to enrol in the education field than men. In the humanities/arts, we see a similar pattern. It is, however, also evident that women are more strongly over-represented in the humanities and arts if they originate from higher social backgrounds. This goes against the intersectionality hypothesis and the asymmetry hypothesis. The gender differences are also declining with regard to the probability to enrol in the STEM field, given that the negative gender effect is getting closer to zero. Note however that women are still strongly under-represented by 30 per cent. In line with the intersectionality hypothesis, women are less under-represented in these fields if they originate from more educated backgrounds. For health, the trend is more strongly curvilinear, with increasing over-representations of women up to the 1950s birth cohorts, with decreasing (but still high levels of) over-representation afterwards.

In the fields of economics/business and the social sciences/law, the pattern is rather different. While the field of economics/business became less male-dominated until the 1970s birth cohorts (with more women entering the field), the over-representation of men increased since then. The increase is, moreover, steepest among children of well-educated backgrounds. The social sciences and law, by contrast, became increasingly stratified by gender, especially since the late 1960s cohorts, while there was hardly any trend before that. In the 1980s birth cohorts, high-SES girls have a 14 per cent higher probability to be enrolled in the social and legal sciences than high-SES men.

Finally, we graph the marginal effects from models run separately by educational level (Figure 4, estimated from Model 5 of Table 2). Some marked differences between levels emerge with regard to gender segregation in specific fields. At universities, the desegregation into the STEM fields has stalled to an extent not seen if all levels are considered simultaneously. We even see a reversal of trend, towards a stronger gender bias in favour of men

Table 4. Multinomial logistic regression models with separate coefficients for fathers' and mother's education; reference category is economics and business

	Education	*Humanities and arts*	*STEM*	*Health*	*Social sciences/law*	*Other field*
Birth cohort	−0.312***	0.294∼	−0.069	0.024	−0.044	−0.127
	(−3.35)	(1.92)	(−1.26)	(0.26)	(−0.50)	(−1.49)
Birth cohort squared	−0.001	0.004	0.002	−0.004	0.004	0.007
	(−0.08)	(0.44)	(0.56)	(−0.54)	(0.60)	(1.03)
Women	2.649***	1.993**	−2.788***	2.912***	1.961***	−0.456
	(6.66)	(3.12)	(−6.29)	(8.03)	(4.80)	(−1.01)
Women × birth cohort	−0.473***	−0.415**	0.039	−0.232*	−0.381**	−0.173
	(−3.79)	(−2.70)	(0.28)	(−1.98)	(−3.09)	(−1.16)
Women × birth cohort squared	0.035**	0.021∼	−0.002	0.009	0.025*	0.013
	(3.29)	(1.66)	(−0.15)	(1.01)	(2.52)	(1.08)
Father's education (reference: ≤ lower secondary)						
Upper secondary	−0.260∼	0.284∼	0.042	−0.019	−0.122	−0.067
	(−1.86)	(1.85)	(0.56)	(−0.15)	(−1.02)	(−0.51)
Tertiary	0.153	0.219	0.066	0.398**	−0.129	0.122
	(1.00)	(1.30)	(0.73)	(2.84)	(−0.97)	(0.77)
Father's education × gender						
Upper secondary × women	0.302∼	−0.250	0.224	0.051	−0.019	0.053
	(1.68)	(−1.15)	(1.44)	(0.33)	(−0.11)	(0.25)
Tertiary × women	−0.024	0.007	0.264	−0.491**	0.092	−0.010
	(−0.12)	(0.03)	(1.46)	(−2.76)	(0.50)	(−0.04)
Mother's education (reference: ≤lower secondary)						
Upper secondary	−0.323*	−0.016	−0.117	0.246∼	0.015	−0.193
	(−1.96)	(−0.10)	(−1.40)	(1.86)	(0.12)	(−1.24)
Tertiary	−0.089	0.260	−0.014	0.272	0.204	0.052
	(−0.39)	(1.27)	(−0.11)	(1.48)	(1.21)	(0.23)
Mother's education × gender						
Upper secondary × women	0.284	0.502*	0.183	−0.039	0.133	0.065
	(1.37)	(2.29)	(1.08)	(−0.24)	(0.76)	(0.26)
Tertiary × women	0.557∼	0.753**	0.572*	0.173	0.613**	0.535
	(1.93)	(2.70)	(2.48)	(0.72)	(2.62)	(1.56)
Students' educational level						
Vocational college	2.903***	5.871***	0.327∼	0.337	2.422***	0.280
	(9.86)	(6.17)	(1.94)	(1.63)	(7.98)	(1.18)
University	0.921*	7.079***	−0.082	0.377	3.465***	−0.036
	(2.44)	(7.43)	(−0.42)	(1.48)	(10.96)	(−0.11)
Students' educational level × gender						
Vocational college × women	0.079	0.680	1.107***	0.312*	0.572**	1.122***
	(0.32)	(1.43)	(7.54)	(2.23)	(2.76)	(6.08)
University × women	0.354	1.016*	2.135***	−0.236	0.603**	2.271***
	(1.12)	(2.12)	(12.44)	(−1.36)	(2.75)	(8.43)
Students' educational level × birth cohort						
Vocational college × birth cohort	−0.045	−0.523***	−0.141***	−0.144***	−0.197***	−0.220***
	(−1.06)	(−4.72)	(−5.72)	(−5.28)	(−4.89)	(−6.06)
University × birth cohort	0.011	−0.526***	−0.068*	−0.075*	−0.170***	−0.294***
	(0.20)	(−4.74)	(−2.34)	(−2.09)	(−3.99)	(−5.58)
Constant	−1.400***	−6.798***	1.167***	−1.160***	−2.439***	−0.134
	(−4.20)	(−6.90)	(6.42)	(−4.09)	(−7.06)	(−0.52)

Note: *t* statistics in parentheses.
Source: AVO 1995–2007 ($N = 15{,}639$).
$\sim P < 0.10$, $^{*}P < 0.05$, $^{**}P < 0.01$, $^{***}P < 0.001$.

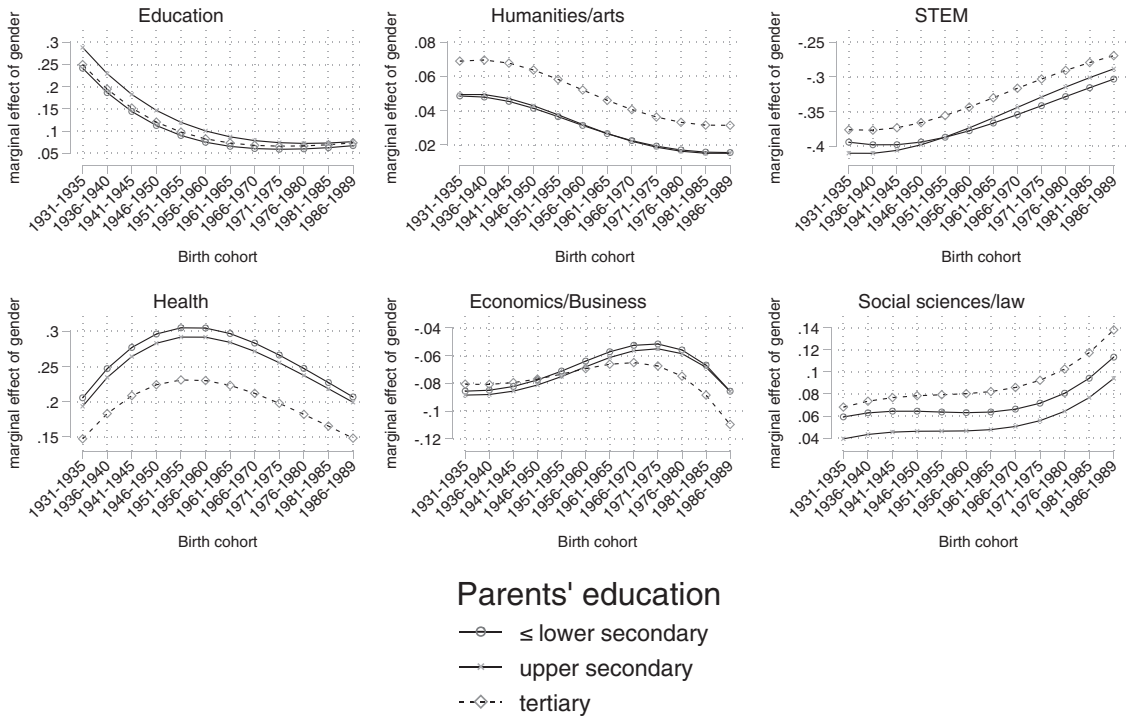

Figure 3. Marginal effects of gender on fields of study, by cohort and parental education*

in this field. Also in the vocational colleges, we see a halt of desegregation, although women are still more likely to enrol in the sciences/math/engineering fields if they originate from higher social origins. In the intermediate vocational schools it appears that women are still on the rise.

The field of health in universities (which, in the Dutch context, usually refers to studying medicine) has turned from a male-dominated to a (slightly) female-dominated field over the course of the twentieth century. Health in the vocational colleges and intermediate vocational schools has been female-dominated throughout the time window, although this is slightly decreasing since the 1950s cohorts. Similar to the overall pattern in Figure 3, the over-representation of women in the humanities is decreasing at the university and vocational college levels. However, in the intermediate vocational schools, we see a steep rise in the over-representation of women in the humanities/arts, but only for children of tertiary-educated parents. This finding illustrates that downwardly mobile children seek fields in which their family cultural capital can be used to advance their position, in ways that Bourdieu (1984: p. 151) had in mind when he wrote that 'those sons and daughters of the bourgeoisie who are threatened with downclassing tend to move [. . .] into the sectors where the new professions are under construction', like the 'sectors of cultural and artistic production'. We find support for this argument particularly for daughters, not for sons of the advantaged social groups.

Importantly, some fields have become increasingly gender-segregated since the 1970s birth cohorts, especially the social and legal fields at the vocational college level (over-representation of women), and economics/business across all levels (over-representation of men). Moreover, at odds with our intersectionality hypothesis, the rising gender segregation seems slightly higher among children of highly educated parents. It should be noted that these are the fields where most of the educational expansion took place (Ramirez, 2006; Van de Werfhorst et al., 2001). Possibly these are the fields where children can more easily maintain, or improve on, the class position of the parents at times when the accessibility of post-secondary education increases.

Summary and Conclusion

This article studied trends in gender segregation across fields of study in post-secondary education. The main interest was whether gender segregation across fields of

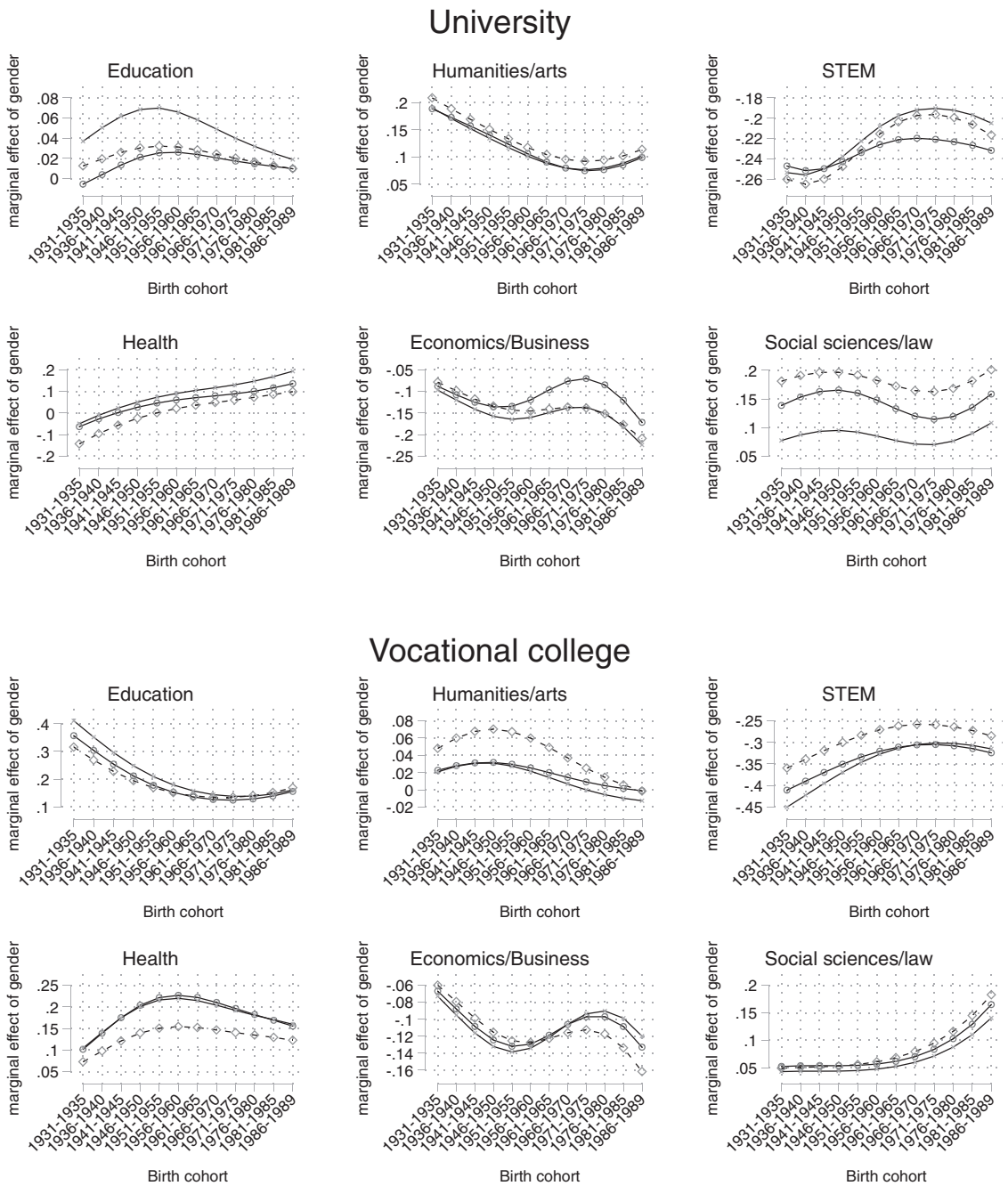

Figure 4. Marginal effects of gender on fields of study, by level of education*

study is different between children of different social origins.

Analysing repeated cross-sectional Dutch survey data for cohorts born between the 1930s and the 1980s, it was shown that gender segregation was declining in the Netherlands. Importantly, while desegregation took place, there are several indications that desegregation has stalled. In line with the *stalled trend hypothesis* (Charles and Bradley, 2009; England and Li, 2006), which argued that rising levels of gender essentialism paved the way for gender-typical choices in educational and occupational careers, we find that the relative rise

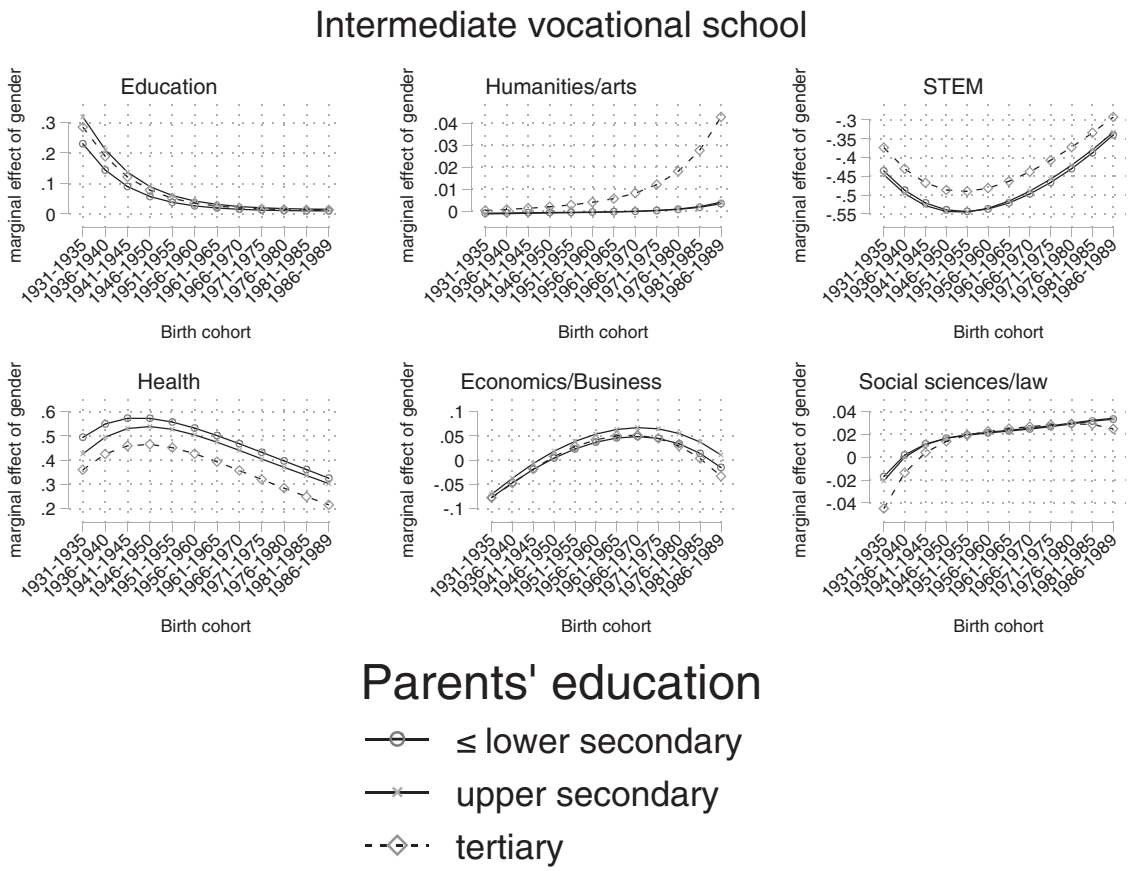

Figure 4. Continued

of women in the STEM fields has come to a halt. Also the desegregation in the humanities and arts has come to a halt, at least in the universities. Exceptions to the overall pattern of desegregation were also found, in the social, legal, and economic fields. Their gender differences in enrolment have increased since the birth cohorts born in the 1970s, while there was hardly any trend before that time.

Moreover, we found lower levels of gender segregation for children of highly educated parents in STEM and in health, suggesting that there indeed is an important intersectionality between social origin and gender. In the vocational colleges, higher-SES men were less under-represented in the health field compared to low-SES men, and in the STEM fields, women are less under-represented. These findings are in line with the *intersectionality hypothesis* stating that socialization is less gendered in highly educated families. However, intersectionality works in different ways. We found the opposite pattern for the humanities and the social sciences: women were even more over-represented in these fields when they originate from a highly educated background, especially if the mother was highly educated. This finding is at odds with the asymmetry hypothesis derived from the work of England (2010), which would imply higher-SES women to avoid the humanities. An alternative explanation may be that children from higher SES backgrounds may be able to be successful within the social and humanistic fields of study, as their family cultural capital can be helpful in generating success (Hansen and Mastekaasa, 2006; Van de Werfhorst et al., 2001). For men this may be less attractive than for women, as it would require them to cross gender lines such that they 'lose money and suffer cultural disapproval' (England, 2010, p. 155). Choosing the humanities or social sciences may also reflect that women 'endulge their gendered selves' (Charles and Bradley 2009: p. 924) especially if they originate from families where self-expression and postmodern beliefs are most likely held. Future scholars could further investigate the specific gendered parent–child patterns concerning the development of such beliefs.

The results offer an important contribution to understanding gender segregation in education. The current literature distinguishes between rational arguments of gender-typical choices in education, with a strong focus on lower mathematics abilities of women compared to men, or a comparative advantage in the languages relative to mathematics for women, and socialization theories on how socializing agents influence the norms that boys and girls develop concerning their future life courses. Given that math achievement tests (or measures of comparative advantage) fail to account for gender segregation across fields of study, most of the literature is supportive of the socialization argument. Girls are socialized towards different careers and lives than boys, partly resulting from different forms of social interaction confirming or disproving gender norms. Such socialization and interaction patterns develop women's preference for humanistic and nurturing specializations, affects their attitudes towards math, their take-up of advanced math courses, and their likelihood to enrol in fields that demand advanced mathematics skills.

However, with the current evidence for an intersectionality between gender and social background, it seems that these two perspectives are not as conflicting as previously thought. In particular, the socialization argument concerning traditional gender roles would be better applicable to children originating from lower-educated backgrounds. For them, the choice for a field of study is part of a more traditional view on their future life course, a view that is reinforced through interactional patterns in families with a traditional household division of labour. This implies that daughters of parents with lower levels of educational attainment, who are upwardly mobile, enter the traditionally more feminized fields of study.

In more highly educated families, social interactions are less clearly supportive of gender-typical norms. Children in these families would be less strongly guided by traditional values, they may more clearly see the benefits that may be reaped from selective fields of study, and they may have higher-level mathematics skills making the STEM fields more attractive. In line with this argument, we found evidence that gender segregation across fields of study varies between SES groups. However, while in some fields, gender differences were smaller among high-SES children than among low-SES children, in other fields, the SES gradients were reversed. Moreover, also the trend analysis showed desegregation in some fields, while other fields became more segregated across cohorts. Some results were in line with the *asymmetry hypothesis* that stated that women are more likely to cross gender boundaries than men (i.e. women going into STEM fields, but men not entering the humanities in greater numbers).

All in all, the contextual impact on gendered choice patterns is highly complex. It seems that women and men only show less-gendered choice patterns among higher-SES backgrounds if the fields that they enrol in are known to have a consistently good position in the labour market. Thus, while we did not explicitly consider the labour market value of educational programmes, SES, and cohort differences in gender segregation can best be understood by a combination of cultural, achievement-oriented, and labour market factors.

Of course our results are based on Dutch data, and it is worth stressing that the Netherlands is, in some ways, a special case in terms of gender inequalities. Despite a stark rise in female labour force participation, women often work part-time, and the Dutch society is still characterized by a strong motherhood ideology. Gender equality in the public sphere, on which the Netherlands scores much lower than Scandinavian countries, is known to be correlated to more egalitarian orientations towards STEM careers (McDaniel, 2016). Nevertheless, even in this gender-traditional country we find declining gender segregation across fields of study. Although we cannot generalize our findings to other countries, it is plausible that gender segregation is lower among more highly educated families in other countries as well.

Notes

1 To illustrate the broad section of the population that is covered, we checked whether enrolment in either of the studied levels together (intermediate vocational schools at MBO-level, tertiary vocational college at HBO-level, or research university level, all value 1), relative to non-enrolment (value 0), was selective by social origin, and whether social selection changed across cohorts. Using the 1999 data that included both parents' education and occupational status, we did not find any significant cohort trend concerning the social gradient in the likelihood to enter our data, neither in a linear nor a higher-order specification, and neither with a linear probability model nor with a logit specification. There is an overall rise in participation though: Since the 1970s birth cohorts, the data include close to 70 per cent of the population, while it was around 50 per cent in the 1950s birth cohorts.

2 Unfortunately parents' education is the only social background variable that was consistently asked in the AVO data in the various years. However, in the AVO-1999 data also information was obtained on parents' occupation and employment. Using this smaller data set, I checked whether parents' occupation was more relevant than parents' education in its interaction with gender, but that was not the case.

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