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ABSTRACT

Searching on Campus? Marriage Market Effects of the Student Gender Composition*

This paper studies marriage market effects of the student gender composition for university graduates using German Microcensus data and aggregate information on the student sex ratio by field of study for 41 different fields from 1977 to 2011. Experiencing a higher own-gender share of students during university education reduces overall marriage market opportunities for women but not for men. Moreover, when students of the own gender are relatively abundant, the probability of having a partner from the same field decreases for women, while men are more likely to marry down with respect to educational status.

JEL Classification: D10, I23, I24, J12

Keywords: marriage markets, sex ratio, higher education, Germany

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1 Introduction

How does the gender composition among university students by field of study affect the marriage market success of university-educated individuals? In many Western societies, women's attainment in higher education has substantially increased over the past decades considerably shifting the male-to-female ratio of university students. In modern societies, educational attainment plays a crucial role in determining individuals' relative position by paying off returns on both the labor market and the marriage market more generally (Goldin, 1997; Lafortune, 2013). Given that individuals typically prefer spouses of similar age and education (Mare, 1991; Kalmijn, 1991), the educational system represents a crucial marriage market for the high-skilled. Being enrolled in university education typically implies being faced with a homogeneous peer group with respect to age and ability right before marrying age (Blossfeld and Timm, 2003).[1] Thus, in addition to having significantly improved labor market opportunities for women (Goldin et al., 2006), the secular trend of more women enrolling in higher education may have shifted marriage market prospects for both male and female university graduates.[2] Imbalanced sex ratios have strong implications for marriage market outcomes in very different settings. Typically the scarcer gender is favored because of reduced partner search costs

[1] In Germany, individuals holding a university degree marry shortly after having completed education. Age at graduation is 28.1 for men and 27.2 for women, while age at marriage is 30.0 and 28.8 respectively (Figure A.1). Individuals with lower levels of education finish much earlier (men: 22.2, women: 21.3) but marry after longer time lags (men: 27.7, women: 25.9). University graduates are also more likely to meet their partner during education or at work (Figure A.2).

[2] Marriage market conditions enhancing couple formation among high-skilled individuals may be a driver of increasingly assortative mating of couples, which has important implications for labor supply (Bredemeier and Juessen, 2013), inequality (Hyslop, 2001; Greenwood et al., 2014; Pestel, 2017) and intergenerational mobility (Ermisch et al., 2006).

and increased bargaining power.[3] However, little is known about the exact mechanisms through which gender imbalances by educational attainment affect individual marriage market prospects.

Using rich micro data from Germany, this paper explicitly addresses the role of higher education as a marriage market for high-skilled individuals and studies the effects of the gender composition among university students by detailed fields of study on marriage market outcomes of university graduates. In Germany, university teaching as well as students' social environment is traditionally very much segmented by fields of study. That is why the *field-specific* gender composition of enrolled students should affect the frequency of meeting potential spouses of the opposite sex.[4] For this purpose, I use administrative information on the gender composition of students enrolled in (West) German universities broken down by 41 detailed fields of study over the period from 1977 to 2011. The aggregate field-by-year data is merged with data from the German Microcensus containing individual information on the year of graduation as well as the exact field of study for university graduates in waves 2003 to 2011. This allows me to exploit substantial over-time and within-field variation in student sex ratios experienced at the time of education to estimate the effect on individual marriage market outcomes such as the marital status and couple

[3] The implications of gender imbalances for bargaining power have been studied by Chiappori et al. (2002); Angrist (2002); Abramitzky et al. (2011). Mansour and McKinnish (2014) study whether disproportionate rates of within-occupation matching of couples are due to preferences for a spouse with the same occupation or due to lower search costs within the workplace environment and find that their results are more in line with a search cost explanation.

[4] Previous literature has used segmentations of (local) marriage markets by *levels* of education. For example, Negrusa and Oreffice (2010) find that more favorable sex ratios by metropolitan area and educational attainment for women reduce wives' labor supply but increases that of husbands. One recent exception is Bičáková and Jurajda (2016) who use European labor force survey data and document a strong tendency of matching partners within eight broadly defined fields of study.

composition. The comparison implicitly underlying the analysis can be illustrated by the following example. A female university student enrolled in a field characterized by a predominantly male student body (e.g. a field in Engineering) encounters male students substantially more often than a student in a predominantly female field (e.g. a field in Humanities). This implies that for women the probability of meeting a potential opposite-sex partner is significantly higher in Engineering fields than in Humanities making within-field marriages more likely. At the same time, students whose gender is relatively abundant within their field of study (i.e. men in Engineering and women in Humanities) are consequently more likely to meet a potential partner outside their field of study or outside the university environment.

The identification of causal effects of the student gender composition by field of study on marriage market outcomes immediately raises concerns of endogenous self-selection into fields mainly driven by marriage market rather than labor market considerations. Students who are mainly interested in finding a university-educated spouse may deliberately choose fields where the own gender is relatively scarce. In that case, the resulting gender composition would result from preferences for specific marriage market outcomes and, hence, reverse causality would be an issue.[5] In addition, the student gender composition may be correlated with a field's as well as its graduates' average unobserved characteristics which could be related to marriage market outcomes. These concerns are addressed in two ways. First, the regression analysis includes field of study fixed effects capturing any unobserved

[5] However, individuals predominantly choosing fields of study where their own gender is scarce would imply that in the longer run the gender composition by field of study should become more balanced. In Section 2, I show that this is true for some fields, but is at odds with the observation that the female share increased in virtually all fields, i.e., also in those that had already been predominantly female. In addition, a number of fields are still predominantly male.

field-specific and time-invariant characteristics. Thus, variation in the gender composition is within fields over time. Building on the previous example, this means that I compare marriage market outcomes of a female student enrolled in an Engineering field with a very low female share of students in the 1970s to a student of the same field in the 2000s when the female share was still low but higher compared to earlier decades holding any specific characterisitcs of women choosing Engineering constant. Second, I exploit information on the extent to which admission to university education in particular fields is restricted. Enrolling in a restricted field is costly from a student's point of view since this may imply "waiting semesters" before actual admission and because the choice of specific university is beyond the control of the individual applicant. This makes it much more likely that the motivation for choosing a restricted field is primarily driven by labor market considerations.

Overall, the analysis shows that the gender composition of fellow students within the field of study during education has significant impacts on marriage market outcomes for university graduates with distinct gender differences. First, a higher female share of students negatively affects marriage market opportunities for women. Female graduates more often remain single or live in a cohabiting couple and are less often married when women represent a larger share of students in the respective field of study. For men, I find the exact opposite result. A higher share of males in the field is associated with a higher probability of being married, while it is less likely to be single or cohabiting. Second, the student sex ratio significantly affects the composition of couples with respect to educational levels and field of study. For women, a higher share of the own gender among fellow students decreases the probability of having a partner holding a degree in the exact same field. However,

I find distinct gender differences for the alternative outcomes of having a partner holding a degree from a different field or having a lower level of formal education. When men are more abundant in the field, male graduates are more likely to "marry down" with respect to educational status, while women are more likely to be in a homogamous relationship when the female share is high. Overall, these results indicate that the pool of potential partners is larger for university-educated men than for women since marrying a partner from outside the university environment with a lower level of education and earnings potential ("marrying down") is more likely for men than for women.

These findings of this paper are consistent with social norms regarding the composition of couples with respect to socio-economic status. For example, Bertrand et al. (2015) study the share of income earned by male and female spouses within the household and show that the likelihood of deviating from *gender identity norms*, stipulating that the husband should be the main earner in the household, affects various socio-economic outcomes. This norm is in line with the observation that women (men) typically tend to "marry up (down)" with respect to the spouse's socio-economic status. In the context of this study, an increase in the female share of students enrolled in a given field to reduces women's frequency of meeting men with similar levels of education. Consequently, the chances of finding a partner with at least the same (high) earnings potential are more limited, making couple formation in line with social norms more difficult and, hence, less likely.

The remainder of the paper is organized as follows: Section 2 describes the data. The empirical strategy and the results are presented in section 3. Section 4 concludes.

2 Data and Descriptives

The aim of this paper is to study whether over-time changes in the sex ratio of students within fields of study drive observed differences in marriage market outcomes for university graduates. In this section, I first describe the overall changes in gender composition by field of study in (West) Germany before I discuss the definition of the estimation sample and present descriptive statistics based on the German Microcensus.

Gender Composition of Students. Based on administrative information from German Statistical Yearbooks (Destatis, 1992, 2012), Figure 1 shows the total number of university students enrolled in (West) Germany as well as the overall gender composition, indicated by the share of females between 1977 and 2011.[6] Over this period, the number of students in Germany more than doubled from about 850,000 to more than two million individuals enrolled in university education in Germany. Over the same period, the gender composition of students has considerably changed. In 1977, about one third of students were women and their share has been continuously increasing to 48% in 2011.[7]

While an increasing share of female university students is observed for virtually

[6] Each data year in the Statistical Yearbooks refers to the latter calender year of winter terms (typically from October to March). Harmonized data are available since 1977. East Germany is included from 1993 onwards.

[7] The observed growth in both the total number as well as the female share of university students is due to several factors. First, the system of tertiary education in Germany expanded rapidly during the 1970s responding to the demand from large birth cohorts in the 1950s and 1960s. The state invested in additional capacities by expanding existing universities and by founding new ones. Second, the women's movement in the 1960s promoted an increase in female participation in university education. This was, third, accompanied by the introduction of a financial support scheme targeted at students from low-income backgrounds, which turned out to be particularly beneficial for women.

all fields of study, the overall change in the gender composition was not uniformly distributed across fields. Figure 2 shows the change in the share of female students by 41 fields of study between 1977 and 2011. The substantial variation indicates that the social environment during university education in terms of the gender composition among fellow students has considerably shifted for older cohorts compared to younger cohorts of university students. A number of fields have actually switched from being predominantly male to predominantly female, for example in Architecture, Law and virtually all fields in Medical Sciences. Despite considerable increases in the share of enrolled women, fields in Engineering are still predominantly male, while fields in Humanities have become even more female. Other fields, like Economics and Business Administration or Agriculture, used to have a low female share and are nowadays rather balanced in terms of the gender composition. Only three fields have experienced very small decreases in the female share of students (Computer Sciences, Sports and Ecotrophology).

Marriage Market Outcomes. The aggregate information on the student gender composition by field of study is merged with micro data from the German Microcensus (2011), which is an annual cross-sectional survey of private households in Germany covering one per cent of the population. In addition to core socio-demographic variables on the individual level, in particular marital status and household composition, the Microcensus data contain detailed information on the level of education and, for individuals holding a university degree, the field of study and the year of graduation since wave 2003. The estimation sample comprises men and women holding a university degree and have non-missing information on the year of gradu-

ation and field of study. The sample is further restricted to individuals aged 30–45 (birth cohorts 1958–1981).[8] Individuals from East Germany are excluded since the information from the Statistical Yearbooks is limited to West Germany until 1992 and only comprises students at East German universities thereafter. In addition, individuals with a non-German nationality are dropped since the data do not allow to disentangle whether foreigners have received their degree at a university in Germany or rather in their home country. Individuals who graduated from university at age 35 or older are dropped, since their period of education may arguably not overlap as much with the age of partner search. Finally, I only use individual observations who either live in a single or couple household (both married and cohabiting) and are not widowed nor divorced.

Summary statistics are presented in Table 1. Overall, the sample comprises 33,489 men (Panel A) and 27,048 women (Panel B). The main outcome variables of interest are marital status and for those individuals living in a couple household the characteristics of the partner with respect to university education and field of study. The share of individuals living in single households compared to couple households is very similar among the samples of men and women respectively. The share of singles is on average 28%–29% and the share living in couple households is around 71%–72%. Individuals living in a couple household are predominantly married, while only 9% of men and 12% of women are cohabiting in an unmarried couple. While

[8] As the timing of graduation as well as marriage among German university graduates is concentrated at ages just below 30 years (see Figure A.1), the lower-bound age restricts the sample to individuals who have mainly completed both education and marital search. Given that the Microcensus does not provide information on marital history and only comprises data on current marital status, the upper-bound age is chosen to restrict the sample to individuals who are most likely in their first marriage.

the marital status is very similar between the samples of men and women there are substantial differences regarding the partner's characteristics. The partners of male university graduates is in most cases a wive without a university degree (38% out of the 72% living in a couple household). About 34% of men holding a university degree live with a partner who has obtained the same level of education. At the same time, female graduates are much more likely to live with a university-educated man (49%) while only 22% live with a lower-educated partner. Among those individuals living with a university-educated partner the fraction of partners having graduated in the very same field of study is about one third (12% out of 34% for men and 17% out of 49% for women).

The distinct gender patterns of selection into fields of study as shown on the aggregate level in Figures 1 and 2 are reflected in the sample of university graduates from the Microcensus data. Table 1 shows that about one third of both male and female university graduates have graduated in a field within Social Sciences (32% and 36% respectively). At the same time, men are substantially more likely to have a degree in an Engineering field (37%) or Natural Sciences (15%) than women (both 10%). About 33% of women have graduated in a field within Human Sciences with the number for men standing at 9%. Moreover, women are somewhat more likely to graduate in a medical field than men (8% vs. 5%). Only 2% of men and 4% of women graduate from Arts.

The observed differences in the choice of field of study are related to the share of the own gender among fellow students at the time of university education. Given that the German Microcensus contains individual information on the field and year of graduation, I am able to match the aggregate information on the male and female

shares of students from the Statistical Yearbooks with the micro data. Table A.1 in the Appendix shows the mean female share for all 41 fields under consideration in the empirical analysis.[9] On average, men experience a 69% male share among students within the field of study while women experience a female share of 52%. This variation in the gender composition across fields and within fields over time will be exploited in the regression analysis.

3 Estimation of Marriage Market Effects

3.1 Empirical Strategy

The empirical strategy exploits variation in the gender composition of university students over time and within field of study to estimate its impact on marriage market outcomes of university graduates. The empirical model reads:

$$y_{icfg} = \alpha + \beta \times shareown_{fg} + X_i'\gamma + W_{fg}'\delta + \mu_f + \mu_c + \varepsilon_{icfg}, \tag{1}$$

where y_{icfg} denotes a marriage market outcome of an individual i of birth cohort c who graduated in field of study f in year g. The outcomes are binary indicators of the marital status (single, unmarried couple and married couple) or the composition of the couple regarding the spouse's level of education and field of study (partner without university degree, partner with degree in same field, partner with degree in different field) as described in the previous section. The main variable of interest is $shareown_{fg}$ corresponding to the *own-gender share* of students experienced during

[9] Figure A.3 shows the distribution of the field-specific female share of students by six field groups for both men and women separately.

university education by individuals who graduated in field f in year g.[10] The set of individual controls X_i include age, age squared and a binary indicator for living in an urban area at the time of the survey, while W_{fg} controls for the log total number of students enrolled in field f in year g. Field fixed effects μ_f control for any unobserved time-invariant field of study characteristics that are related to the frequency of meeting opposite-sex individuals. Importantly, this takes into account that some fields have been traditionally male- or female-dominated (e.g. fields in Engineering vs. fields in Humanities). Hence, I only exploit variation in the gender composition *within* fields over time. Moreover, field fixed effects take into account any unobserved characteristics (e.g. personality traits) of individuals selecting into particular fields which may related to marriage market behavior and outcomes. Birth cohort fixed effects μ_c control for any impact common to birth cohorts that may influence marriage market outcomes (e.g. the gender composition of students across all fields of study or changing social norms over time). Equation (1) is estimated separately for men and women using a linear probability model with standard errors ε_{icfg} clustered on the field by graduation year level.

3.2 Main Results

Effects on Marital Status. The analysis of marriage market effects of the gender composition among university students begins by examining the impact of the own-gender share on outcomes related to marital status, i.e., whether a university-educated individual is single, is cohabiting or married at the time of the survey.

[10] In a robustness check, I assign the own-gender share in up to ten years before the year of graduation.

The estimation results are displayed in Table 2. Panel shows the results for the sample of university-educated men. Overall, I find that a higher own-gender (male) share of students significantly *improves* marriage market prospects of men. Being faced with a higher male share among fellow students during university education reduces the probability of being single (see columns (1)–(3)) and cohabiting in an unmarried couple household (columns (4)–(6)). At the same time, the results in columns (7)–(9) indicate that a higher male share of students significantly increases the probability of being married: a one percentage point higher share of male students reduces the probability of being single or unmarried by about 0.6 and 0.4 percentage points respectively and increases the probability of being married by one percentage point when including the full set of controls and fixed effects. At first sight this pattern of results on the marital status of university-educated men may be surprising since a relative abundance of the own gender within the social environment is expected to be associated with higher competition and higher search costs on the marriage market. Note, however, that the marital status outcomes are not specific to the level or even field of the partner's education. A higher male share within the educational peer group seems not to harm, but to improve educated men's chances on the overall marriage market.

The results for university-educated women are presented in Panel B of Table 2 and show the exact opposite pattern compared to men. Women who experienced a higher share of females during university education within their field of study are significantly more likely to remain single or unmarried, while the prospects of being in a married couple is strongly reduced. A one percentage point increase in the own-gender share reduces the probability of being married by about 1.5 percentage

points for women. Overall, the results for marital status outcomes imply that for university-educated women a relative scarcity of male students within the field of study hampers couple formation, in particular regarding entering marriage. At the same time, a high male share does not impair men's marriage market prospects. Note that the secular trend for virtually all fields of study described in the previous section is characterized by an increasing female (i.e. decreasing male) share of students. This means that the observed changes in the gender composition of university students impairs the likelihood of entering marriage for both male and female graduates.

Effects on Couple Composition. The results discussed in the previous paragraph show that the own-gender share among university students within the field of study affects couple formation in general. We now turn to outcomes related to the composition of couples with respect to the level of education, i.e., whether an individual's partner has attained university education as well, and whether university-educated partners are from the same or from a different field of study.

The results are displayed in Table 3. The estimates in Panel A for university-educated men show that after including all controls and fixed effects a higher own-gender share only significantly affects the margin of having a partner without university education (column (9)). A one percentage point higher male share among students during university education increases the probability of finding a partner outside the university education system by 0.83 percentage points. The estimated effects on having a partner holding a university degree as well, either from the same or from a different field, are slightly negatively but not statistically significantly affected (columns (3) and (6)). This finding is consistent with the results on marital

status. When men are abundant within the field of study, they are apparently more likely to expand their search for a potential spouse outside the university environment and are also more likely to be successful. This implies that male graduates are also more willing to "marry down" with respect to the level of education than women.

The results for women holding a university degree in Panel B indicate that a higher female share of students during education significantly reduces the probability of having a partner with a degree within the very same field of study. For a one percentage point higher own-gender share this probability is reduced by one third of a percentage point (column (3)). This is consistent with the notion that partner search costs on the marriage market are lower when being outnumbered by the opposite gender (Mansour and McKinnish, 2014).

An increasing own-gender share implying reduced relative scarcity increases search costs and makes within-field mating less likely. Turning to the alternative outcomes for couple composition again shows that results for women are opposite in sign compared to the results for men. A one percentage point higher female share of students significantly increases the probability of women having a partner holding a university degree from a different field by 0.35 percentage points and reduces the probability of having a lower-educated spouse by almost one percentage point (columns (6) and (9)). This means that university educated women's partner search seems to be strongly affected by the gender composition of fellow students during university education.

These findings indicate that there are gender-specific preferences for marrying up or down the educational ladder. When the female share among fellow students

is higher, making within-field partner search more costly and more difficult, an important alternative search pool seems to be the university environment more generally, including different fields of study. Hence, educated women seem to prefer to marry a spouse from the same educational level or remaining single over "marrying down" the educational ladder.[11] At the same time, men are more likely to search for partners outside the university environment, implying heterogamous marriage with respect to education.

3.3 Additional Results and Robustness

Admission restrictions. In order to address potential concerns regarding selection into fields of study being mainly driven by marriage market rather than labor market considerations, I present estimation results exploiting field-specific information on admission restriction rules. In Germany, admission to university education in specific fields can either be restricted at the central (federal) level or at the local (university) level. Central restriction of admission implies that only applicants whose overall score in their secondary school leaving examination (*Abitur*) passes a minimum threshold, which differs across fields and over time.[12] The main purpose is to allocate applicants for a place at university in fields where demand exceeds available capacities which mainly, but not exclusively, applies to fields in Medical Sciences. In addition, individual universities may also define their own admission

[11] Another mechanism behind these results could be the fact that the overall female share of students has always been below 50% for the entire sample though increasing over time (see Figure 1). Hence, female students may be overrepresented in some fields, but are always outnumbered on aggregate, making the wider university environment more attractive for partner search.

[12] In addition, waiting time as well certain quotas for disadvantaged groups are also used as auxiliary criteria.

restriction rules for specific fields. For this purpose, I compile administrative information on annual field-specific admission restrictions from the German Rector's Conference (*Hochschulrektorenkonferenz*), an umbrella organization of German universities. The dataset is based on annual publications listing the situation of admission restriction (free admission, local restriction or central restriction) for each field at each university in Germany. This allows me to compute an index of admission restriction ranging from zero (free admission) and 100% (admission fully restricted). Values in between give the percentage of German universities where admission to the respective field is restricted in a given year. Over the period under consideration between 1977 and 2011, the extent of admission restriction varies substantially both across fields and within fields over time, see Figures A.4 and A.5. Enrolling in university education in a field where admission is restricted may not fully rule out the possibility that the motivation for choosing the respective field is driven by marriage market considerations. However, I argue that this much less likely since enrolling in a restricted field is costly from an individual's point of view. First, some applicants may have to wait one or more semesters before they are actually admitted. Second, particularly the central level restriction typically implies that the choice of specific university is beyond the control of the individual applicant. Both aspects substantially increase the opportunity costs of choosing a restricted field of study, making it much more likely that the motivation is primarily (if not only) driven by labor market considerations. For this reason, I run regressions where the sample is restricted to individuals who graduated from a field of study where admission was restricted to large extent, indicated by the percentage of admission-restricted universities, five years prior to graduation. The results are shown in Figures 3 and 4

and indicate that the effects of gender composition in restricted fields are very much in line with the baseline results.

Randomly assigned field of study. In order to further corroborate the validity of the baseline estimation results, I run regressions with placebo treatments by randomly assigning the gender composition of artificially assigned fields of study to individual observations while keeping the year of graduation fixed. This exercise is repeated 100 times for each outcome as well as for the samples of men and women separately and yields distributions of the coefficient estimates (β in equation (1)). The results are shown in Figures 5 and 6. The vertical dashed lines indicate the point estimates from the baseline regression results presented in Tables 2 and 3. In almost all cases, the baseline point estimate is significantly different and more pronounced than the distribution of placebo treatment effects except for those outcomes where the baseline effect is anyway not significantly different from zero. For most outcomes the distribution of placebo effects is not centered around zero (solid horizontal lines) indicating statistically significant effects of the placebo treatments. This is due to the fact that the gender composition of university students for a given graduation year are strongly correlated and consequently pick up the "true effect" of the gender composition within the actual field of study. What is reassuring for the analysis, is the fact that the baseline estimate is usually significantly outside the distribution of placebo effects. This indicates that the actually experienced gender composition during university education has more pronounced impacts on marriage market outcomes of university graduates.

Non-linear relationship. The regression results presented in Tables 2 and 3 are based on a linear specification of equation (1). However, non-linear relationships between the gender composition in the field of study and the marriage market and couple composition results may be plausible as well. For example, the linear estimates may be driven by individuals who experienced extremely unbalanced gender compositions. For this purpose, I run specifications of equation (1) where the continuous own-gender share is replaced by a series of indicators for specific levels of the gender share. The results for marital status outcomes are shown in Figure 7 and reveal a fairly linear pattern. Figure 8 shows the respective results for couple composition. Here, it stands out that the effect for women on having a same-field partner is mainly driven by women having experienced a female share of students below 50%.

Timing of relevant gender composition. In the baseline specification, the gender composition assigned to each individual is based on the exact field of study and the year of graduation in that field. However, a university graduate's field-specific gender composition reflecting marital search conditions may not be the one that prevailed in the year of graduation, i.e., at the end of education, but rather the one at the beginning of or during the course of study. Unfortunately, the year of starting university education is not available in the Microcensus data. That is why I present regression results assigning the gender composition of students between one and ten years before the year of graduation.[13] The results are presented in Figures 9

[13] For example, in the baseline specification an individual who graduated in 2000 is assigned the respective field-specific gender share in that year. In the alternative specifications the individual is assigned the gender share that prevailed in 1999, 1998, and so on.

and 10 and are very similar to the baseline specifications (equal to zero years before graduation). This is not surprising given the fact that, while the gender composition has changed substantially in some fields of study over several decades, the year by year levels are highly correlated. However, it turns out that those results assigning the gender composition between zero and five years before graduation are more pronounced than those assigning the gender composition more than five years prior to graduation. This is consistent with a typical duration of university education of about five years.

4 Conclusions

This paper studies how the gender composition among university students by field of study affects marriage market outcomes of university graduates in Germany. Using rich data from the German Microcensus combined with aggregate information for more than 40 fields of study over the period 1977–2011, I exploit over-time variation in the gender composition within fields of study.

The main findings of the paper show that the gender composition of fellow students within the field of study experienced during education has significant impacts on marriage market outcomes for university graduates with distinct gender differences. First, a higher own-gender share of students negatively affects marriage market opportunities for women by increasing the probability of remaining single and reducing marriage rates, while the opposite is true for men. Second, an imbalanced student sex ratio significantly affects the composition of couples in terms of education and the field of study. A higher share of the own gender decreases the

probability of having an opposite-sex partner from the exact same field for women. At the same time, men are more likely to marry down with respect to educational status, while women rather have a partner with the same level of education.

Overall, the results of this study are in line with gender identity norms with respect to couple formation, implying that women typically prefer to "marry up" the socio-economic ladder (Bertrand et al., 2015). These findings imply that changes in the gender composition of students may have implications for the socio-demographic composition of societies since we may expect increases in assortative mating of couples when the formation of same-field relationships is enhanced in male-dominated fields. This may have longer-run impacts on income inequality and intergenerational mobility. At the same time, further increases in the female share of students in fields already dominated by women may increase the number of university-educated women remaining single (longer), which may in turn have negative implications for fertility among high-skilled women.

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Figures and Tables

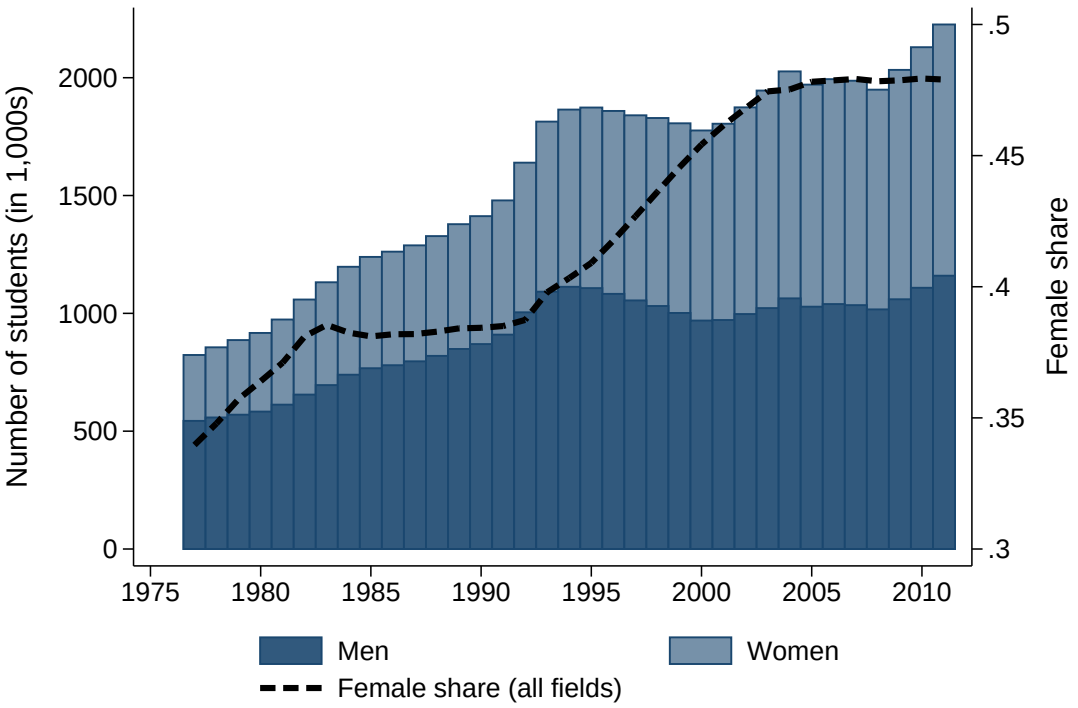

Figure 1: University students in Germany

Note: This bar chart shows the total number of university students in Germany by gender and over time (left axis) as well as the corresponding share of female students (right axis). *Source*: Statistical Yearbooks, own calculations.

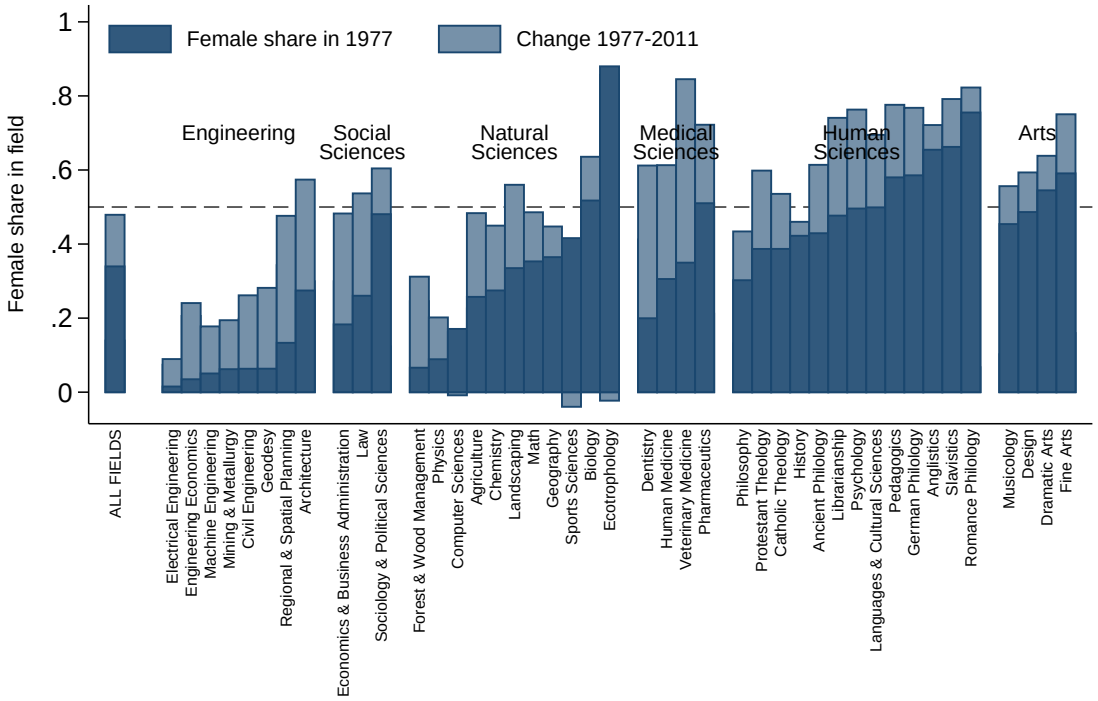

Figure 2: Gender composition of university students by field of study

Note: This bar chart shows the female share of students by field of study in 1977 (darker bars) and its change between 1977 and 2011 (lighter bars). Adding the height of the two bars gives the female share of students in 2011. The horizontal line indicates a female share of 50%, where the gender composition is perfectly balanced. *Source*: Statistical Yearbooks, own calculations.

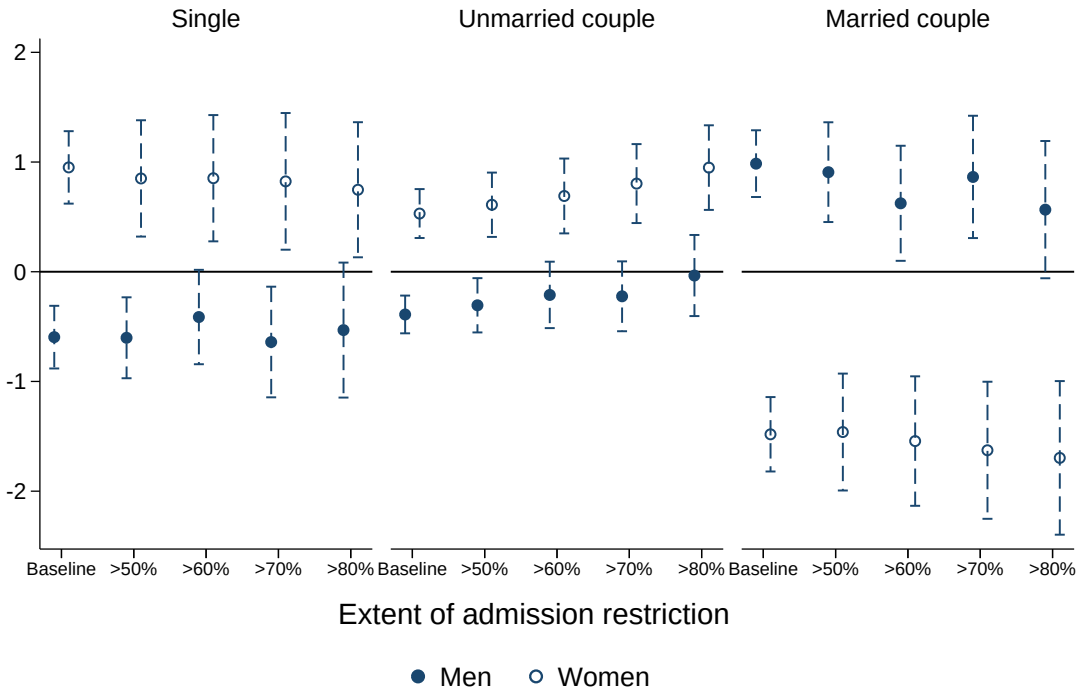

Figure 3: Effects of gender share on marital status for restricted fields

Note: This graph shows estimation results for the coefficient β from 30 separate regressions of equation (1) for alternative sub-samples with respect to the extent of field-specific admission restrictions five years prior to individual graduation. The baseline estimates shows the respective results from Table 2 and can be compared to the estimates for samples of individuals whose field was characterized by a level of admission restriction of more than 50%, 60%, 70% or 80%. Each scatter point indicates the respective point estimate for the gender share. The vertical whiskers indicate 95% confidence intervals. *Source*: Statistical Yearbooks & Microcensus 2003–2011, own calculations.

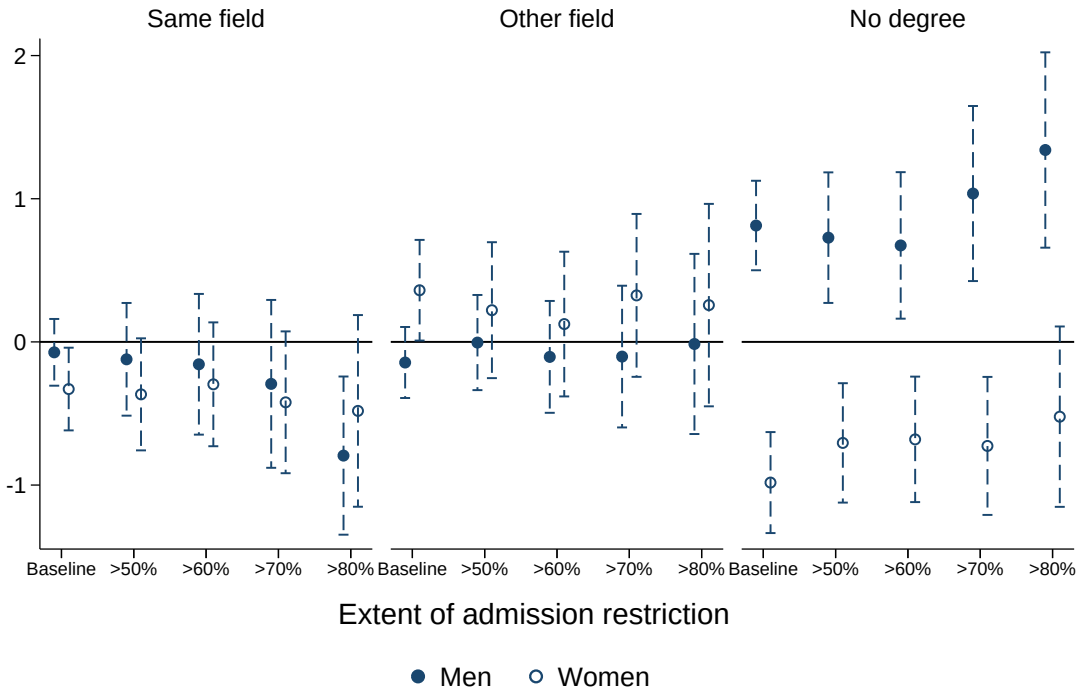

Figure 4: Effects of gender share on couple composition for restricted fields

Note: This graph shows estimation results for the coefficient β from 30 separate regressions of equation (1) for alternative sub-samples with respect to the extent of field-specific admission restrictions five years prior to individual graduation. The baseline estimates shows the respective results from Table 3 and can be compared to the estimates for samples of individuals whose field was characterized by a level of admission restriction of more than 50%, 60%, 70% or 80%. Each scatter point indicates the respective point estimate for the gender share. The vertical whiskers indicate 95% confidence intervals. *Source*: Statistical Yearbooks & Microcensus 2003–2011, own calculations.

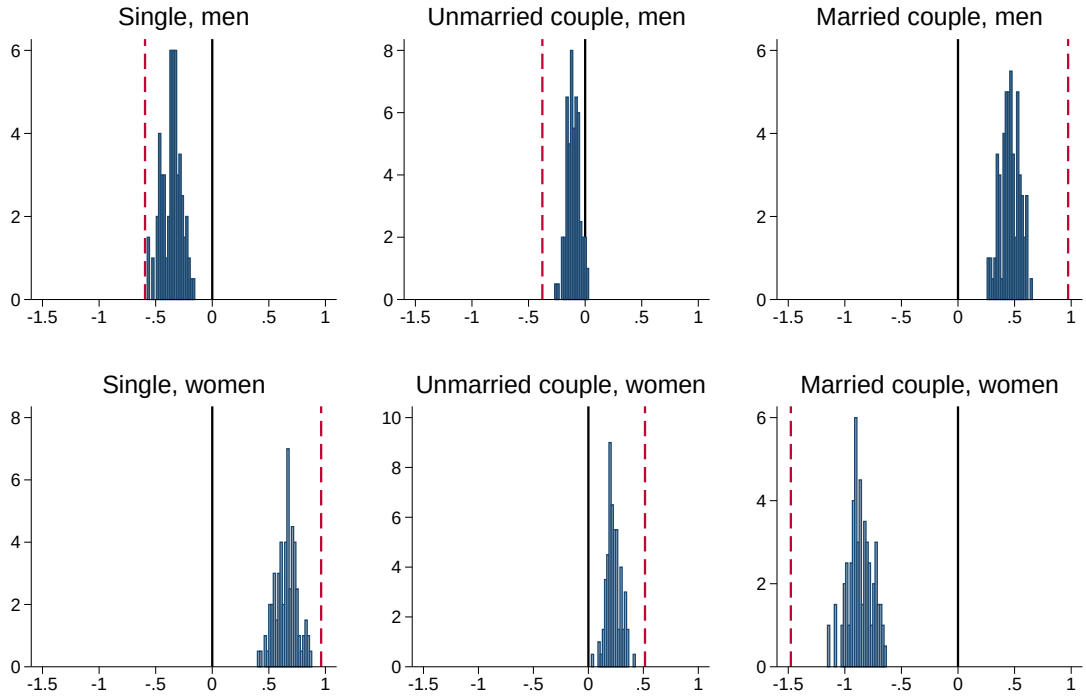

Figure 5: Randomly assigned field of study: marital status

Note: This graph shows the distribution of estimation results for the coefficient β in equation (1) from 100 replications (per outcome and sample) of randomly assigning the field of study to individual observations when holding the year of graduation fixed. The dashed vertical line indicates the estimate of the baseline estimates as shown in Table 2. *Source*: Statistical Yearbooks & Microcensus 2003–2011, own calculations.

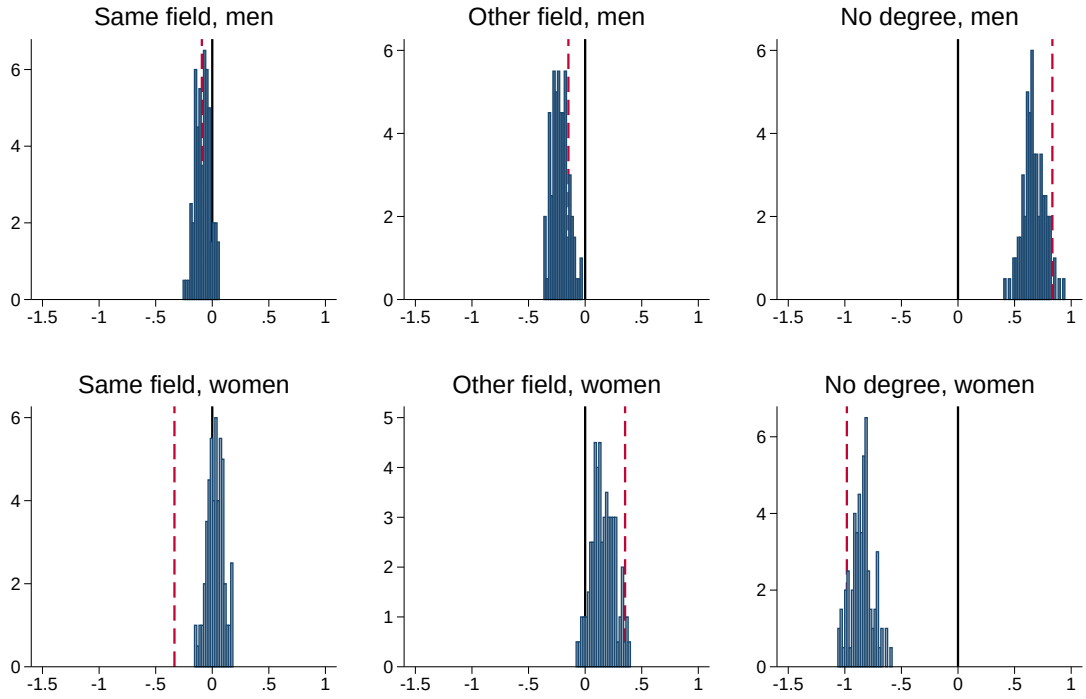

Figure 6: Randomly assigned field of study: marital status

Note: This graph shows the distribution of estimation results for the coefficient β in equation (1) from 100 replications (per outcome and sample) of randomly assigning the field of study to individual observations when holding the year of graduation fixed. The dashed vertical line indicates the estimate of the baseline estimates as shown in Table 3. *Source*: Statistical Yearbooks & Microcensus 2003–2011, own calculations.

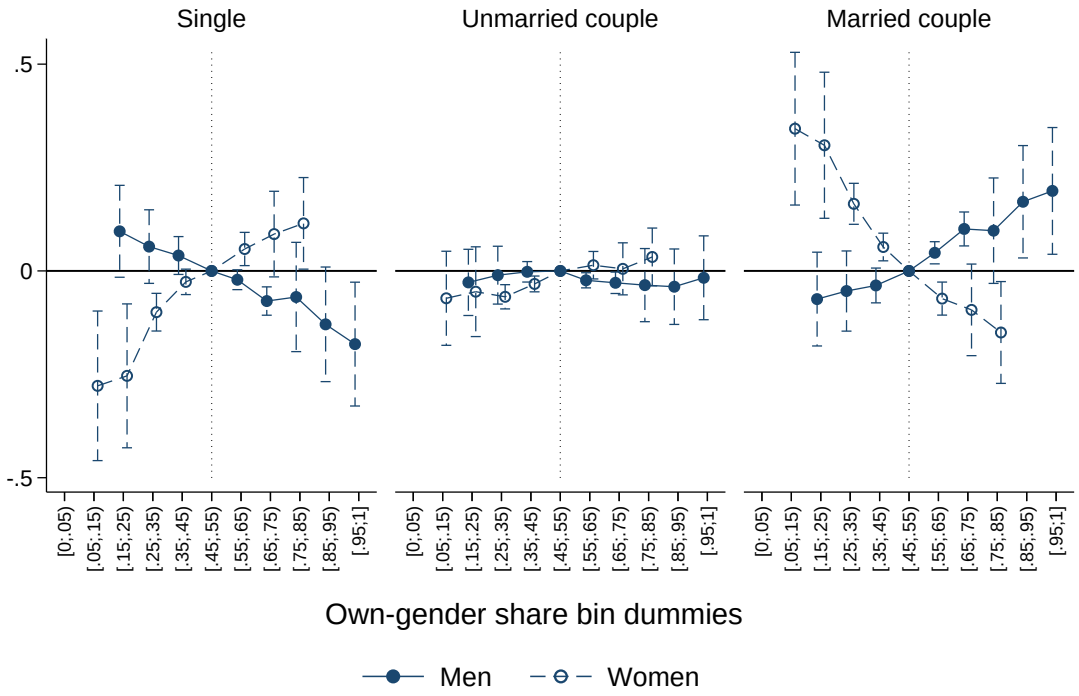

Figure 7: Non-linear effects of gender share on marital status

Note: This graph shows estimation results for the coefficient β from six separate regressions of equation (1) replacing the linear effect of the own-gender share with a series of bin dummies with width 0.1. Each scatter point indicates the point estimate for the respective bin dummy. The omitted category is a gender share between 0.45 and 0.55. The vertical whiskers indicate 95% confidence intervals. *Source*: Statistical Yearbooks & Microcensus 2003–2011, own calculations.

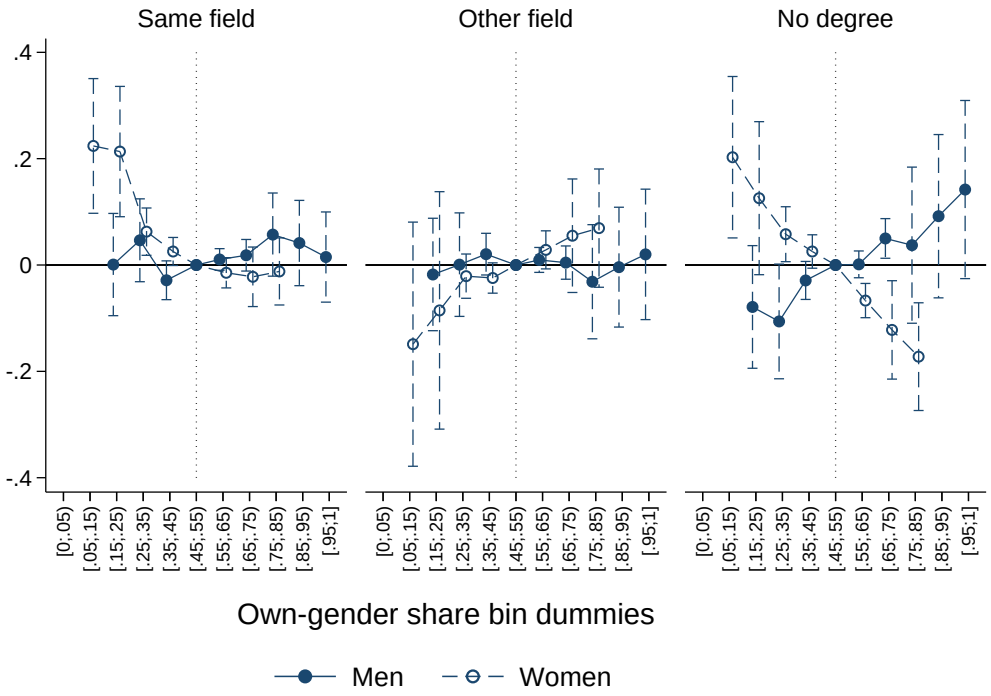

Figure 8: Non-linear effects of gender share on couple composition

Note: This graph shows estimation results for the coefficient β from six separate regressions of equation (1) replacing the linear effect of the own-gender share with a series of bin dummies with width 0.1. Each scatter point indicates the point estimate for the respective bin dummy. The omitted category is a gender share between 0.45 and 0.55. The vertical whiskers indicate 95% confidence intervals. *Source*: Statistical Yearbooks & Microcensus 2003–2011, own calculations.

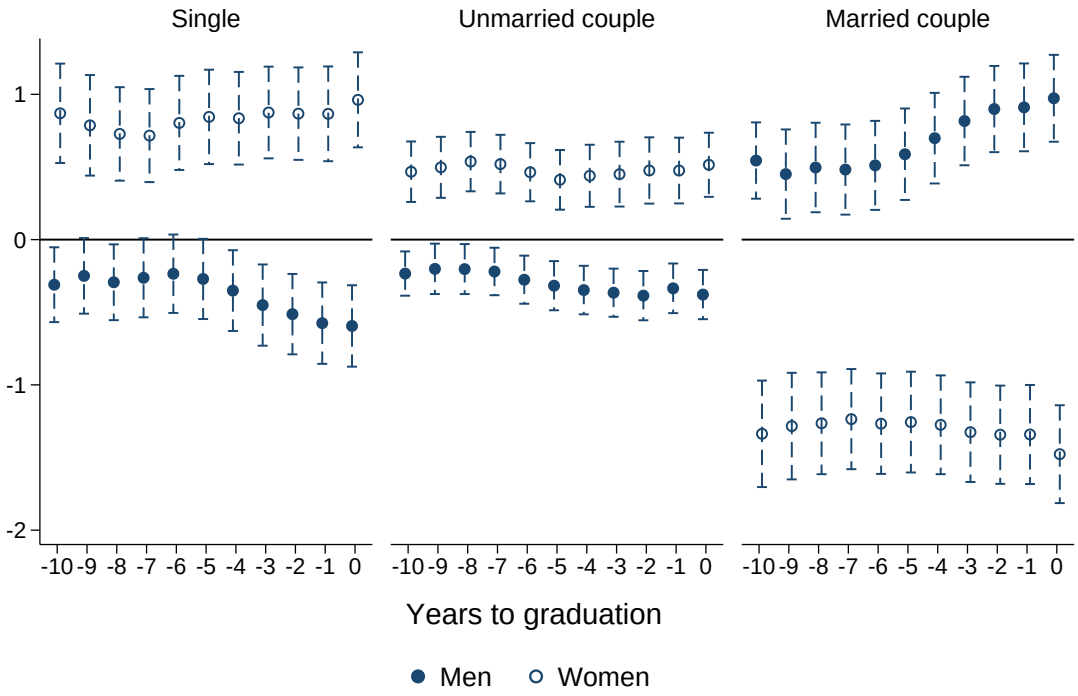

Figure 9: Effects of gender share on marital status for different lags

Note: This graph shows estimation results for the coefficient β from 66 separate regressions of equation (1) for alternative definitions of the field-specific gender composition's timing, employing lags $l \in \{0, ..., 10\}$ with respect to an individual's year of graduation g. Zero years before graduation is the baseline specification shown in Panel A of Table 2. Each scatter point indicates the respective point estimate for the gender share. The vertical whiskers indicate 95% confidence intervals. *Source*: Statistical Yearbooks & Microcensus 2003–2011, own calculations.

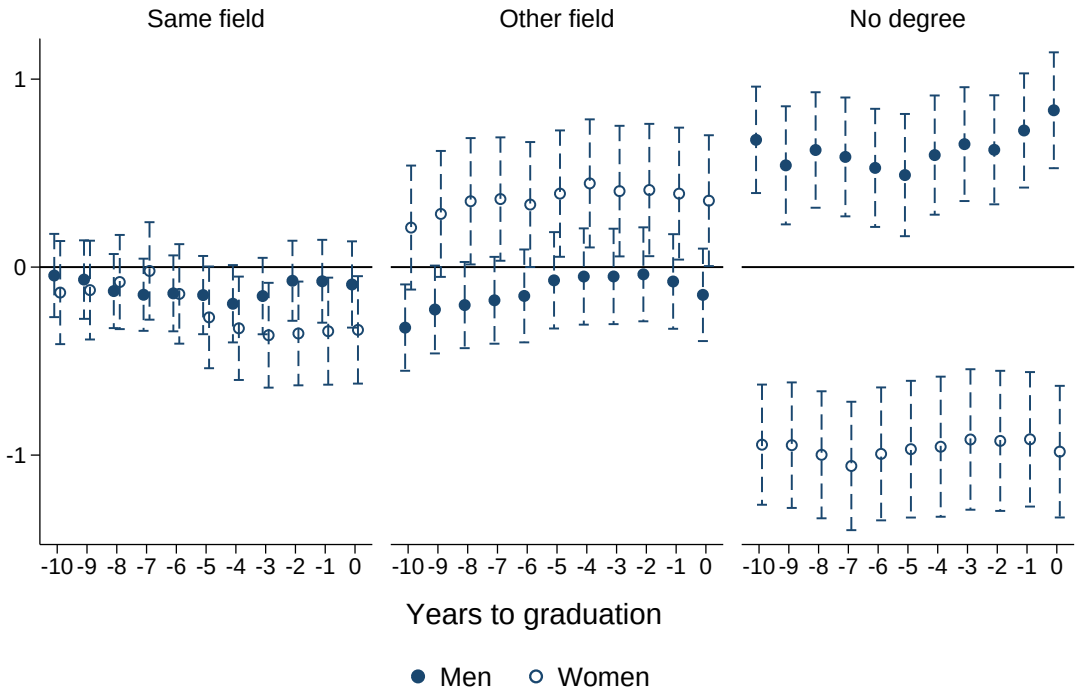

Figure 10: Effects of gender share on couple composition for different lags

Note: This graph shows estimation results for the coefficient β from 66 separate regressions of equation (1) for alternative definitions of the field-specific gender composition's timing, employing lags $l \in \{0, ..., 10\}$ with respect to an individual's year of graduation g. Zero years before graduation is the baseline specification shown in Panel A of Table 3. Each scatter point indicates the respective point estimate for the gender share. The vertical whiskers indicate 95% confidence intervals. *Source*: Statistical Yearbooks & Microcensus 2003–2011, own calculations.

Table 1: Summary statistics

	A. Sample of Men				B. Sample of Women			
	Mean	Sd	Min	Max	Mean	Sd	Min	Max
Marital status								
Single	.28	.45	0	1	.29	.45	0	1
With partner	.72	.45	0	1	.71	.45	0	1
Married	.63	.48	0	1	.59	.49	0	1
Unmarried	.09	.29	0	1	.12	.32	0	1
Partner characteristics								
Partner no univ. degree	.38	.48	0	1	.22	.41	0	1
Partner with univ. degree	.34	.47	0	1	.49	.5	0	1
Partner in same field	.12	.32	0	1	.17	.38	0	1
Partner in other field	.22	.42	0	1	.32	.47	0	1
Field of study characteristics								
Field in Social Sciences	.32	.47	0	1	.36	.48	0	1
Field in Human Sciences	.09	.28	0	1	.33	.47	0	1
Field in Natural Sciences	.15	.36	0	1	.1	.3	0	1
Field in Medical Sciences	.05	.23	0	1	.08	.27	0	1
Field in Engineering	.37	.48	0	1	.1	.3	0	1
Field in Arts	.02	.13	0	1	.04	.19	0	1
Own-gender share in field	.69	.2	.11	.99	.52	.19	.02	.89
Log of students in field	11.29	1	7.15	12.69	11.23	.94	7.26	12.69
Other controls								
Year of birth	1969.14	4.95	1958	1981	1970.89	4.98	1958	1981
Age	38.2	4.37	30	45	36.6	4.35	30	45
Living in urban area	.24	.43	0	1	.29	.45	0	1
Observations	**33489**				**27048**			

Note: This table shows summary statistics on marital status and field of study for a sample of university-educated individuals aged 30–45 in Germany. The *own-gender share* in the field of study refers to the year of an individual's graduation. *Urban area* indicates whether the individual lives in a city with more than 500,000 inhabitants. *Source*: Statistical Yearbooks & Microcensus 2003–2011, own calculations.

Table 2: The effect of the own-gender share on marital status

Dependent variable	(1)	(2) Single person	(3)	(4)	(5) Unmarried couple	(6)	(7)	(8) Married couple	(9)
A. Sample of Men									
Own-gender share	-0.042**	-0.481***	-0.594***	-0.037***	-0.301***	-0.378***	0.079***	0.781***	0.973***
	(0.018)	(0.123)	(0.143)	(0.009)	(0.068)	(0.087)	(0.017)	(0.126)	(0.152)
Observations	33489	33489	33489	33489	33489	33489	33489	33489	33489
Adjusted R^2	0.120	0.130	0.131	0.021	0.022	0.023	0.163	0.172	0.173
B. Sample of Women									
Own-gender share	0.007	0.512***	0.962***	-0.003	0.380***	0.515***	-0.004	-0.891***	-1.477***
	(0.020)	(0.128)	(0.167)	(0.012)	(0.090)	(0.113)	(0.023)	(0.137)	(0.172)
Observations	27048	27048	27048	27048	27048	27048	27048	27048	27048
Adjusted R^2	0.059	0.065	0.066	0.035	0.037	0.037	0.103	0.111	0.114
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Field FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Cohort FE	No	No	Yes	No	No	Yes	No	No	Yes

Note: Controls include age, age squared and an indicator for living in an urban area. Standard errors are clustered on the level of field by graduation year. *** = significant at the 1 percent level, ** = significant at the 5 percent level, * = significant at the 1 percent level.

Table 3: The effect of the own-gender share on partner's education and field

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Partner with degree in same field			Partner with degree in other field			Partner no degree		
A. Sample of Men									
Own-gender share	-0.369***	-0.085	-0.092	0.121***	-0.493***	-0.148	0.290***	1.058***	0.834***
	(0.017)	(0.098)	(0.117)	(0.014)	(0.108)	(0.125)	(0.020)	(0.119)	(0.157)
Observations	33489	33489	33489	33489	33489	33489	33489	33489	33489
Adjusted R^2	0.058	0.075	0.076	0.012	0.021	0.022	0.090	0.105	0.106
B. Sample of Women									
Own-gender share	-0.284***	-0.360***	-0.334**	0.169***	0.325**	0.353**	0.108***	-0.477***	-0.982***
	(0.017)	(0.126)	(0.146)	(0.021)	(0.132)	(0.178)	(0.019)	(0.142)	(0.179)
Observations	27048	27048	27048	27048	27048	27048	27048	27048	27048
Adjusted R^2	0.031	0.044	0.045	0.020	0.025	0.025	0.022	0.038	0.041
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Field FE	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes
Cohort FE	No	No	Yes	No	No	Yes	No	No	Yes

Note: Controls include age, age squared and an indicator for living in an urban area. Standard errors are clustered on the level of field by graduation year. *** = significant at the 1 percent level, ** = significant at the 5 percent level, * = significant at the 1 percent level.

A Appendix

Figure A.1: Age at completing education and marriage

Note: This graph shows the distribution of individuals' age at completing education and age at marriage by gender and level of education. *Source*: Microcensus 2003–2011, own calculations.

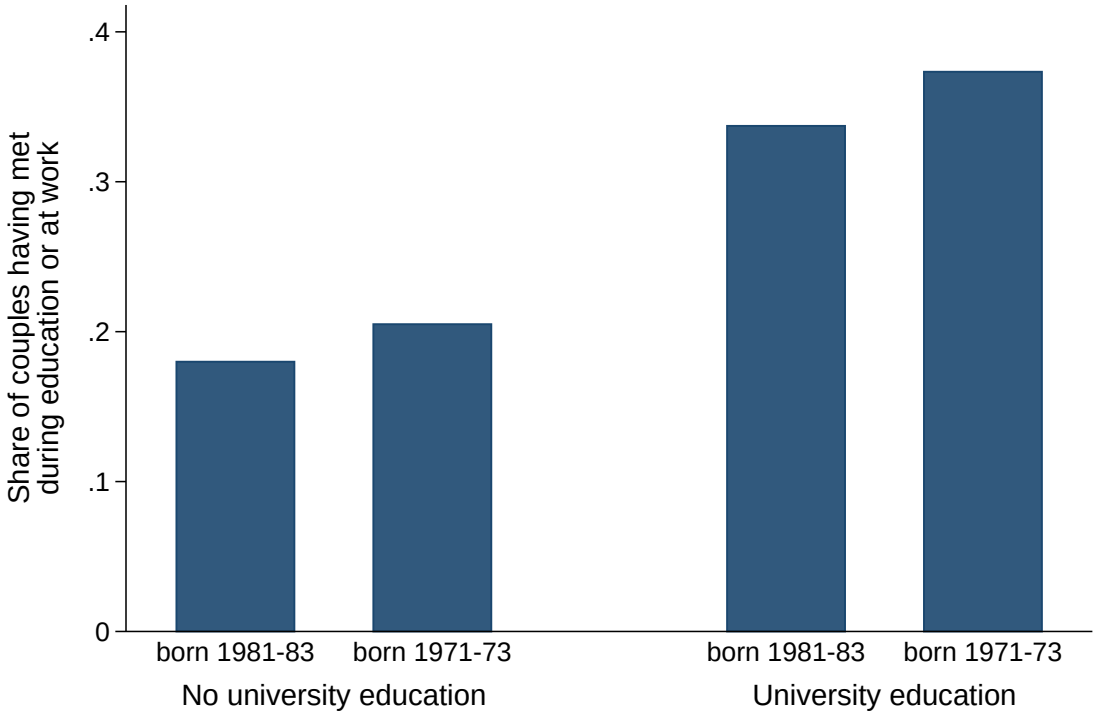

Figure A.2: Meeting of partner during education or at work

Note: This graph shows the fraction of couples who state that they have met in school, during education or at the workplace by level of education and birth cohort. *Source*: Panel Analysis of Intimate Relationships and Family Dynamics (pairfam), wave 1 (2008/2009), own calculations.

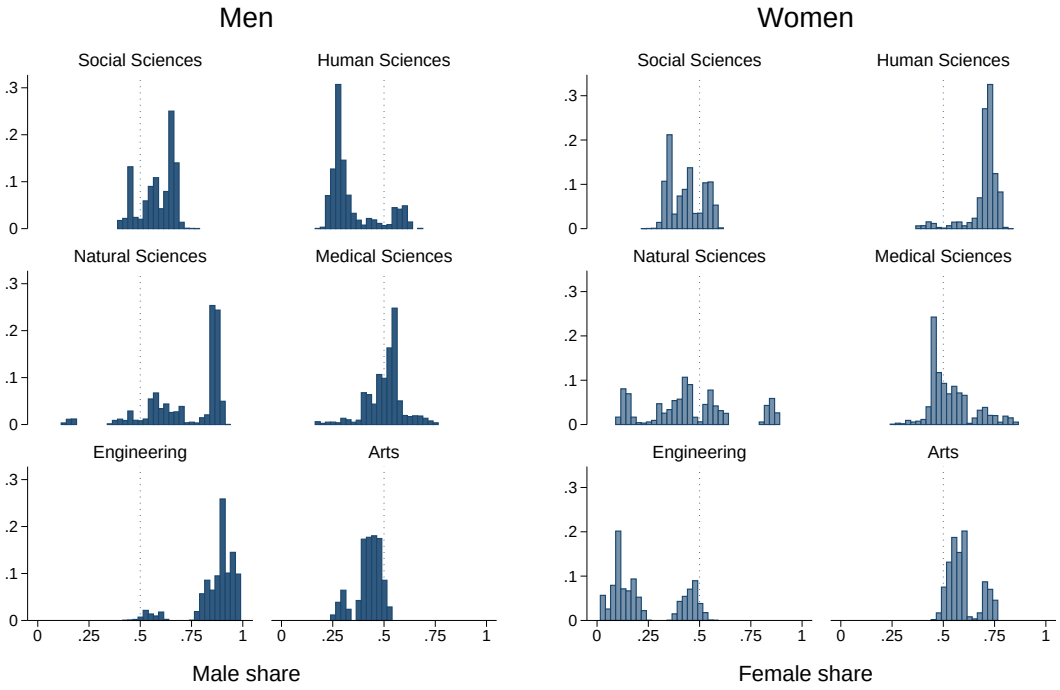

Figure A.3: Distribution of female share within field of study by field group

Note: This histogram graph shows the distribution of the gender share among students within field of study during university education by field groups. The vertical dashed lines indicate a perfectly balanced gender composition with a female share of 50%. *Source*: Statistical Yearbooks & Microcensus 2003–2011, own calculations.

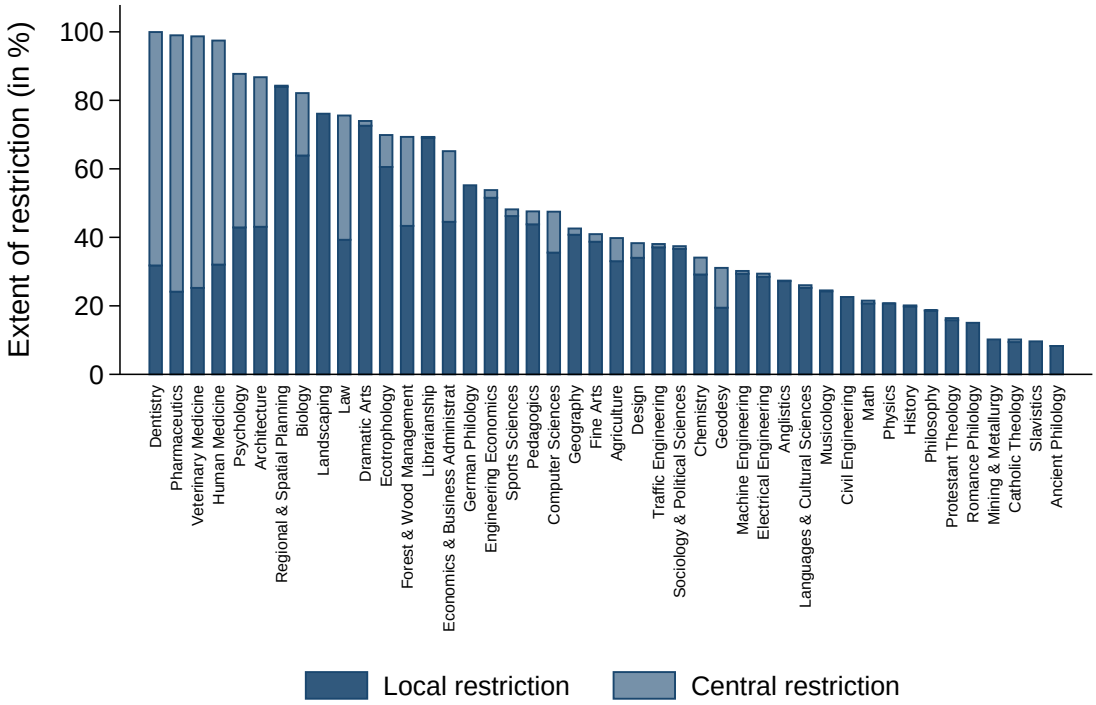

Figure A.4: Average level of admission restriction by field of study

Note: This bar graph shows the mean percentage of German universities where admission to university education is restricted (centrally or locally) over the period 1977–2011 by field of study. *Source*: German Rectors' Conference (*Hochschulrektorenkonferenz*, HRK), own calculations.

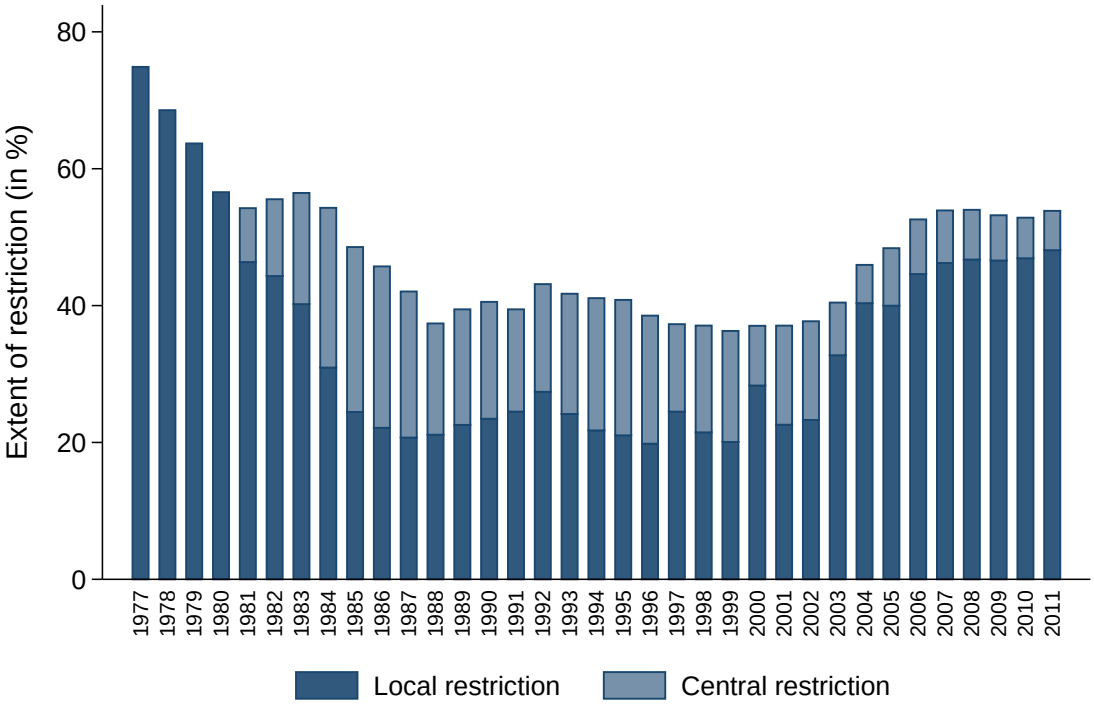

Figure A.5: Average level of admission restriction by year

Note: This bar graph shows the mean percentage of German universities where admission to university education is restricted (centrally or locally) for all fields of study by year. *Source*: German Rectors' Conference (*Hochschulrektorenkonferenz*, HRK), own calculations.

Table A.1: Summary statistics: Female share by field of study

Field group	**Female share**		**Observations**		
Field	Mean	Sd	Men	Women	Total
Social Sciences	**.42**	**.08**	**10754**	**9733**	**20487**
Law	.45	.03	1641	1773	3414
Economics and Business Administration	.37	.04	7061	5428	12489
Sociology and Political Sciences	.55	.02	2052	2532	4584
Human Sciences	**.69**	**.09**	**2851**	**8815**	**11666**
Languages and Cultural Sciences	.67	.02	58	163	221
Protestant Theology	.53	.05	62	66	128
Catholic Theology	.46	.04	86	67	153
Pedagogics	.72	.03	1720	6133	7853
Philosophy	.4	.02	235	157	392
Psychology	.7	.05	138	471	609
History	.44	.01	132	146	278
Librarianship	.58	.03	133	331	464
Ancient Philology	.54	.02	15	36	51
Anglistics	.71	.01	84	454	538
Romance Philology	.78	.01	10	106	116
Slavistics	.74	.03	43	144	187
German Philology	.72	.03	135	541	676
Natural Sciences	**.33**	**.21**	**5004**	**2710**	**7714**
Math	.43	.03	420	325	745
Agriculture	.38	.04	310	210	520
Sports Sciences	.43	.02	155	162	317
Computer Sciences	.14	.01	2149	345	2494
Physics	.13	.03	625	102	727
Chemistry	.34	.05	372	252	624
Biology	.57	.03	330	598	928
Geography	.41	.03	290	251	541
Forest and Wood Management	.19	.06	223	102	325
Ecotrophology	.85	.02	130	363	493
Medical Sciences	**.52**	**.1**	**1822**	**2079**	**3901**
Human Medicine	.5	.05	1361	1474	2835
Dentistry	.43	.09	331	229	560
Veterinary Medicine	.73	.09	90	194	284
Pharmaceutics	.7	.03	40	182	222
Engineering	**.15**	**.12**	**12442**	**2658**	**15100**
Machine Engineering	.11	.03	5184	871	6055
Mining and Metallurgy	.11	.05	713	97	810
Architecture	.45	.04	925	879	1804
Civil Engineering	.18	.03	1471	430	1901
Traffic Engineering	.03	0	134	4	138
Electrical Engineering	.04	.01	3099	197	3296
Engineering Economics	.15	.03	916	180	1096
Arts	**.59**	**.07**	**616**	**1053**	**1669**
Fine Arts	.71	.02	87	234	321
Dramatic Arts	.59	.02	95	103	198
Musicology	.53	.02	271	350	621
Design	.58	.02	163	366	529
Total	**.4**	**.22**	**33489**	**27048**	**60537**

This table shows the full list of fields of study employed and the numbers of observation of individuals in the miceodata holding a degree in the respective field as well as the average female share prevailing in the resprective year of graduation. *Source*: Statistical Yearbooks & Microcensus 2003–2010, own calculations.