Marriage Markets on the Campus: University Education and Assortative Mating in Germany, 1952–2012

Preliminary work in progress – Please do not quote!

Nico Pestel*

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Abstract

This paper analyzes how the gender composition of university students has affected marriage market outcomes of German academics. Exploiting the variation in the female share of students over the period 1952–2012 and across field of study, I estimate the effect on the likelihood of homogamous marriage with respect to educational levels. I find that men have a more than 50 percentage points lower probability marrying a university-educated woman when the female share within the respective field tends to zero, controlling for cohort and field effects. For increasing shares of female students, the likelihood of homogamous marriage increases for men, but decreases for women. A similar pattern holds for being married to a spouse with a degree in the same field. These results indicate that the university campus represents an important marriage market for academics. They are consistent with the notion that the gender composition of the relevant peer group is crucial for marriage market outcomes and assortative mating specifically.

JEL Classification: D10, I23, I24, J12, J16
Keywords: assortative mating, marriage markets, university education, Germany

* Institute for the Study of Labor (IZA), P.O. Box 7240, 53072 Bonn, Germany, Tel.: +49 228 3894–160, Fax: +49 228 3894–510, E-mail: pestel@iza.org.
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1 Introduction

Marriage markets plays a crucial role for the formation of couples, particularly regarding economically relevant characteristics, such as ability and education. This is why marriage market outcomes have important implications for fertility and intergenerational mobility as well as bargaining power within couples and labor supply behavior. A key parameter that characterizes the marriage market structure is the sex ratio of the relevant population, which typically favors individuals of the gender that is relatively scarce.

This paper studies how the gender composition of university students has affected marriage market outcomes of academics in Germany. Specifically, I investigate whether men (women) who obtained a university degree are more likely to be married to a spouse with the same level of education when the female share of students while studying is high (low). For this, I exploit the large variation in the gender composition of students over time and across fields of study in Germany between 1952 and 2012.

I use micro data from the German Socio-Economic Panel (SOEP) and combine these with information on the female share of university students over time and across field of study obtained from annual publications in the German Statistical Yearbooks. I employ a probit model and estimate the effect of the female share of students within field on marriage market outcomes of individuals with a university degree. Specifically, I look at homogamous marriage indicating assortative mating by level of education.

I find that studying while the female share of students within the field is high is strongly positively related to being married to a spouse with a degree in the same field for men, while the effect is negative for women. Specifically, men have a more than 50 percentage points lower probability marrying a university-educated woman when the female share tends to zero, controlling for cohort and field effects. For increasing shares of female students, the likelihood of homogamous marriage increases for men, but decreases for women. A similar pattern holds for being married to a spouse with a degree in the same field.

These results indicate that the university campus represents an important marriage market for academics in Germany and are consistent with the notion that the gender composition of the relevant group of peers is crucial for marriage market outcomes and assortative mating specifically. Previous studies have shown that variations in the sex ratios across regions, ethnic groups, educational level and socio-economic status not only directly affect marriage prospects of individuals, but can have important implications for long-run economic and social outcomes via this channel.

For example, the likelihood of marriage strongly affects fertility (Bitler and Schmidt, 2012) and, hence, intergenerational mobility, when ability and education of both parents are positively and strongly correlated. Similarly, this holds for long-term inequality when scarcities on the marriage market restrict social mobility (Edlund, 1999; Abramitzky et al., 2011). Finally, imbalances in the sex ratio have been found to be a key parameter determining bargaining power within couples (Chiappori et al., 2002), which can ultimately affect labor supply decision of both men and women (Angrist, 2002; Negrusa and Oreffice, 2010).

The paper is organized as follows: Section 2 gives an overview of the development of the gender composition of university students as well as the theoretical considerations underlying this study. The empirical strategy is laid out in section 3. Results are presented in section 4. Section 5 concludes.

2 Background

Growing female share among students. The overall number of university students in Germany has been strongly growing during the period between the early 1950s and recent years (see Figure 1). In 1952, the total number of students enrolled in university education was about 100,000 and has been growing constantly to more than two million students in 2012. At the same time, the gender composition has changed tremendously. In 1952, only 17% of students were women. However, the female share has increased especially during the 1970s. This growth can be explained by several factors. For example, the university system expanded rapidly

in the 1970s. State governments invested in the expansion of existing as well as in the foundation of new universities. This led to a substantial increase in the overall attainment in higher education for both men and women. In addition, the women's movement that started during the late 1960s also led to an increase in female participation in university education. This was accompanied by the introduction of an important federal financial support scheme ($BAf\ddot{o}G$) targeted at students with low-income parents in 1971. Today, the gender gap in enrollment in university education is almost closed. In 2012, about 47% of students were women.

While the general trend of an increasing share of female students in university is observed across all fields of study, there is large heterogeneity in the extent as well as the timing of these changes (see Figure 2 for an arbitrary selection of specific fields). Some fields have always been predominantly male or female, while others have changed from a typical male to a typical female subject. For example, around 35% of medical students already in the 1950s, i.e., significantly above the total share, were female and the share has increased to above 60% in recent years. There female share has even been much larger for students of Pedagogics (mainly school teachers) and increased from 60% in the 1970s to almost 80% in 2012. The opposite holds true for Electrical Engineering, which has always been and still is a predominantly male field with a female share of essentially zero 60 years ago and still below 10% in recent years. At the same time, the female share of students in Law has increased from 10% to more than 50% over the past decades.

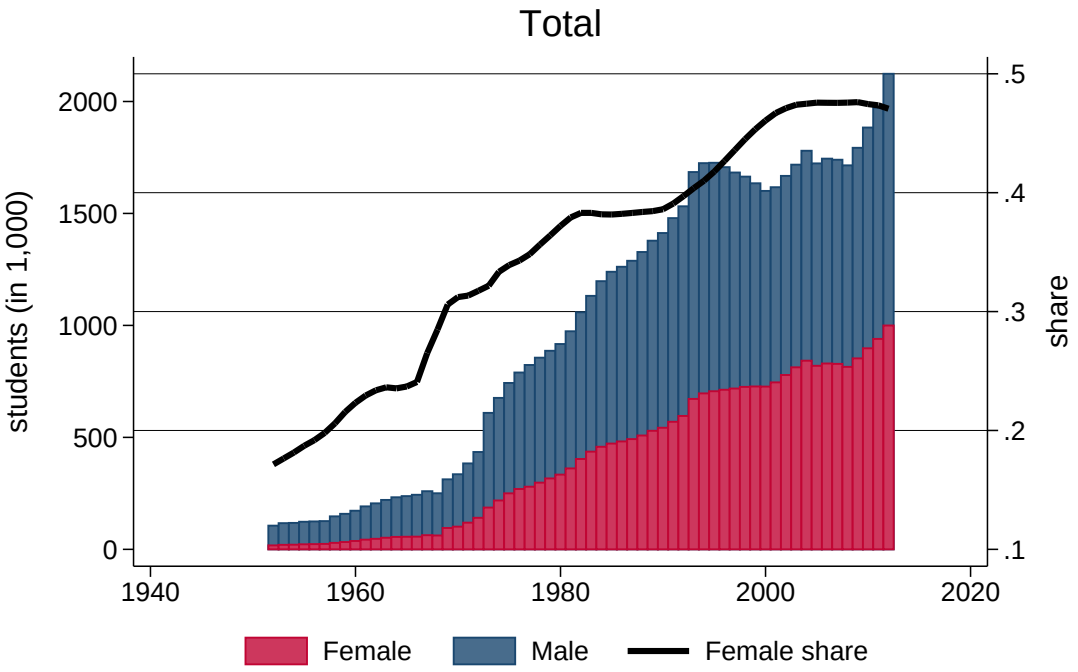

Figure 1: University students in Germany (1952–2012)

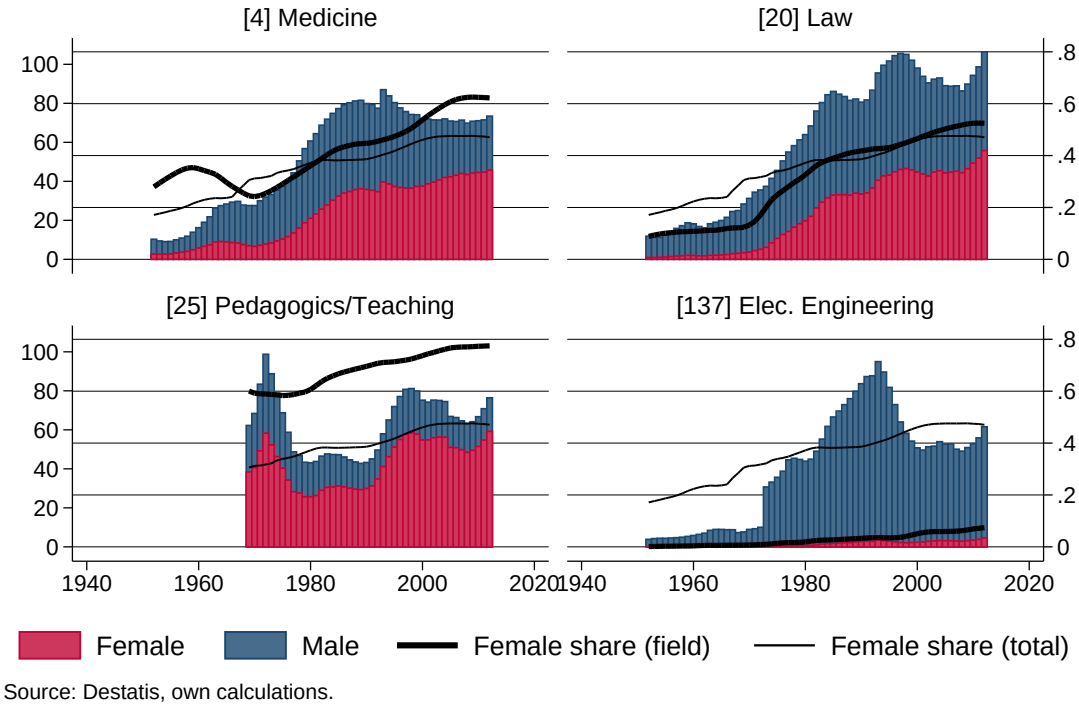

Figure 2: University students in Germany in selected fields (1952–2012)

Framework. The following analysis is based on the argument that individuals typically prefer to be coupled with partners with similar traits, especially with regard to economically important characteristics, such as ability and education. Hence, one can expect that there will be positive sorting of couples (assortative mating) when the pool of potential spouses – the relevant marriage market – is sufficiently large.

However, there are a number of constraints related to couple formation that are particularly relevant for academics. First, couple formation and especially marriage is typically concentrated at younger age. Second, the availability of preferred potential partners of the opposite gender at young age can be very limited. Both types of restrictions are important with respect to marriage markets for university students, since the age of partner search and university education (or career entry after graduation) very often coincide. Moreover, there is huge variation in the sex ratio (the number of female students over male students) across fields of study. Hence, the female share of university of students by cohort and field, which is akey indicator of the marriage market structure, can be expected to affect the likelihood of assortative mating.

This leads to the hypothesis that the female share among fellow students affects the likelihood of marriage among academics, particularly within the same field. The effect is expected to be positive effect for men and negative for women, since an unbalanced sex ratio typically favors the gender that is relatively scarce (Edlund, 1999; Angrist, 2002; Abramitzky et al., 2011).

3 Empirical Analysis

In this section, I describe empirical regression model that I employ to estimate the effect of the female share of students over time and by field on the likelihood of assortative mating in couple formation of academics. The binary outcomes of interest Y_{itf} for an individual i, who started university education in year t in field f are *being married to a spouse with a university degree in general* and *being married*

to a spouse with a degree in the same field. The regression model reads

$$Y_{itf} = \alpha + \beta\ share_{tf}^{fem} + \gamma\ female_i + \delta\ share_{tf}^{fem} \times female_i + X_{itf}\mu + \varepsilon_{itf}. \quad (1)$$

The main explanatory variables of interest are the female share $share_{tf}^{fem}$ as well as its square to allow for non-linear effects and the interaction with a indicator variable for being a woman ($female_i$). Further controls X_{itf} are the total female share in year t as well as the log of the total number of students in field f and year t. Moreover, I include binary controls for field, birth cohort (grouped in 5-year bins),for being not born in Germany and for being from East Germany.

Data. The Federal Statistical Office in Germany provides information on the total number and gender composition of university students (Destatis, 1992, 2012). I extract the total number by gender and for 51 fields for the period from 1952 to 2012, where each year refers to the later calender year of the winter terms (typically from October to March). Universities in East Germany are included from 1993 onwards.[1] See Tables 3 and 4 in the Appendix for a summary of the female share over time and across fields.

Information on the female share of students across fields and over time is merged with micro-data from the German Socio-Economic Panel Study (SOEP, see Wagner et al., 2007; Socio-Economic Panel, 2011, for an overview), which is a panel survey of individuals and households in Germany with annual data waves since 1984. The SOEP's biography data (SOEP Group, 2012) provide information on the marital as well as the educational history of a sub-sample of individuals. I extract from this the exact starting year of higher education and first marriage of individuals and their spouses respectively. Moreover, the data contain information on the field wherein individuals obtained a university degree. Hence, I can determine for each individual in the sample the share of women enrolled in the same field during at the

[1] Due to single missing data years (in 1956 and 1974) and a small number of structural breaks in the data collection between 1970 and 1976, data have been linearly interpolated based on the data before and after. This was necessary for the following individual fields: Spatial Planning (1970–1972), Geosciences (1973–1974), Engineering Economics (1973–1975) and several fields that overlap with school subjects (such as Math, Biology, German, etc.) between 1973 and 1976 (during this period there was a separate field "Teaching" without further specifying the field).

time of entry into university education.

Sample selection. I restrict my sample to individuals who obtained a degree from a German university (West German before 1993) and who have been ever married until the latest survey interview. For individuals, who have been divorced and have re-married later on, I focus on the first observed marriage and the respective spouse. However, I exclude individuals who had entered marriage already before entering university education are after the age of 50. Finally, I am restricted to individual observations, for which information on the own as well as the spouse's level and field of education is not missing. This renders a total sample of 1,950 observations, which comprises 1,298 men (67%) and 652 women (33%). The share of individuals whose first spouse has a university degree is 57% (1,102). A sub-sample of 273 individuals is married to a partner with a degree in the same field, which corresponds to 33% of the observations where the spouse's field is not missing.

Descriptive Statistics. Figure 3 shows the age distribution at university entry as well as at first marriage for the sample used and separately for men and women. It reveals that university entry is typically very much concentrated in the early 20s, while first marriages are slightly more dispersed, mainly between ages 25 to 35. This underlines that couple formation closely follows entry into university education.

The distribution of the female share both by field and in total is displayed in Figure 4. While the distribution of the total share is very similar for males and females, the distribution of field-specific female shares is unsurprisingly unbalanced: Men (women) are more represented in fields where the female share is low (high).

The distribution of cohorts represented in the estimation sample is shown in Figure 5 alongside with the respective means of the outcome variables of interested. The share of women with a tertiary degree born in the 1930s married to a man with the same educational level in general is over 90% and decreases for younger cohorts, but is still around 50% for women born in the 1980s. For men, this share is much lower for the 1930s cohorts (around 30%) and increases slightly to around 50%, i.e., the same share as equally-aged women. The share of individuals married to a spouse in the same field more specifically is fairly constant across cohorts from the 1930s

to the 1970s for both genders in the range 20–30% but is very low for young cohorts born in the 1980s.

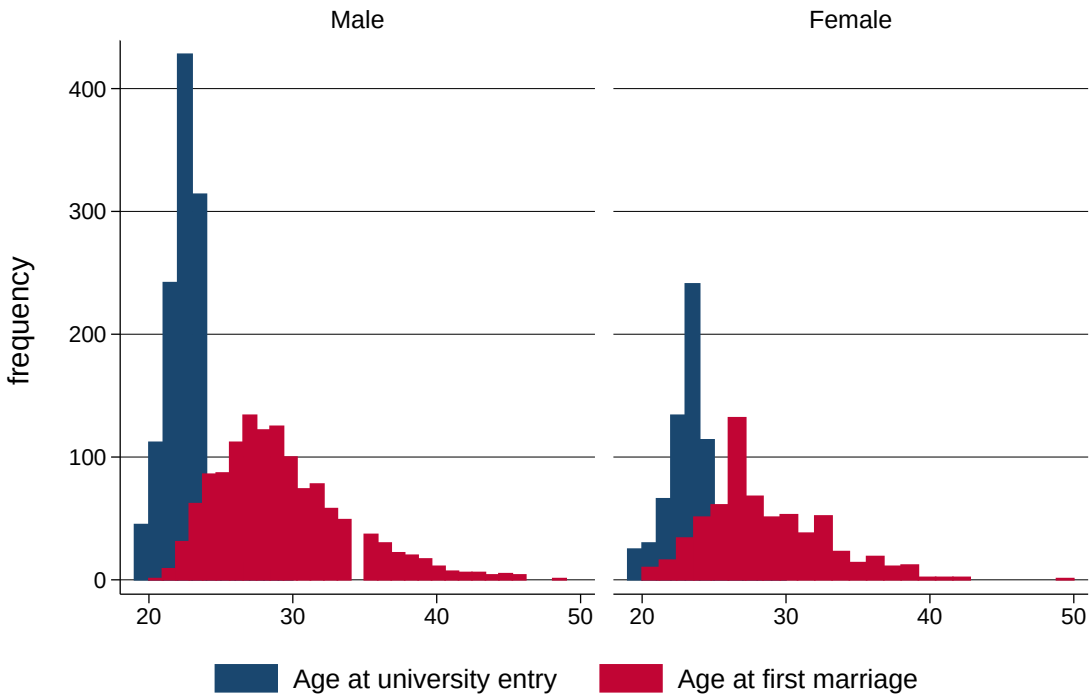

Figure 3: Age distribution at university entry and at first marriage

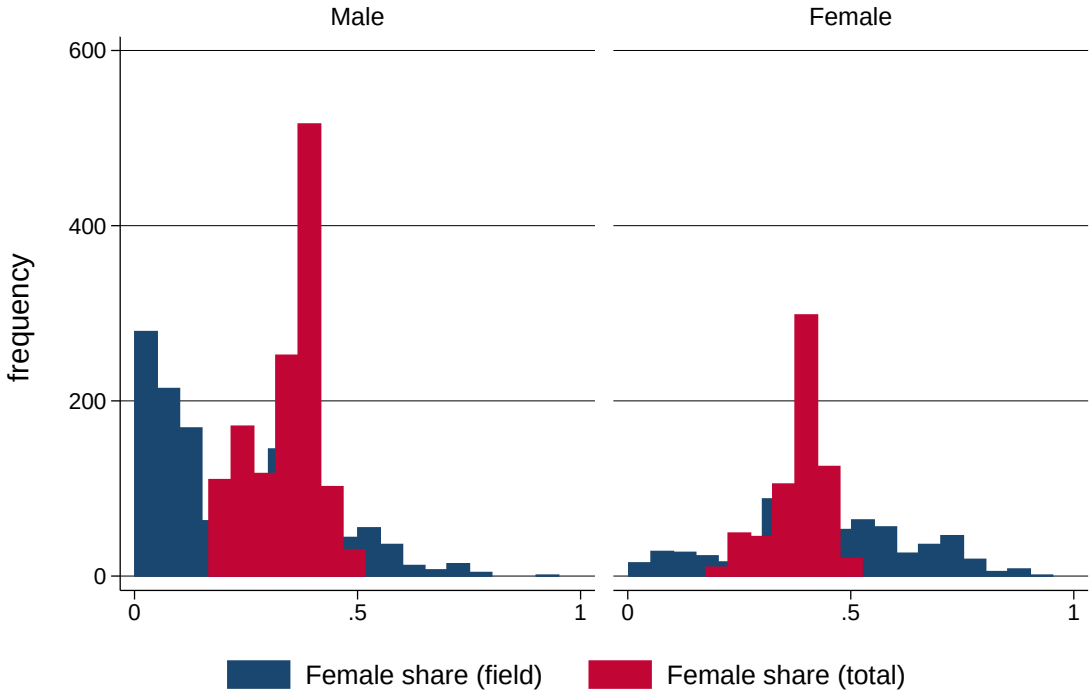

Figure 4: Distribution of female share during university education (total/own field)

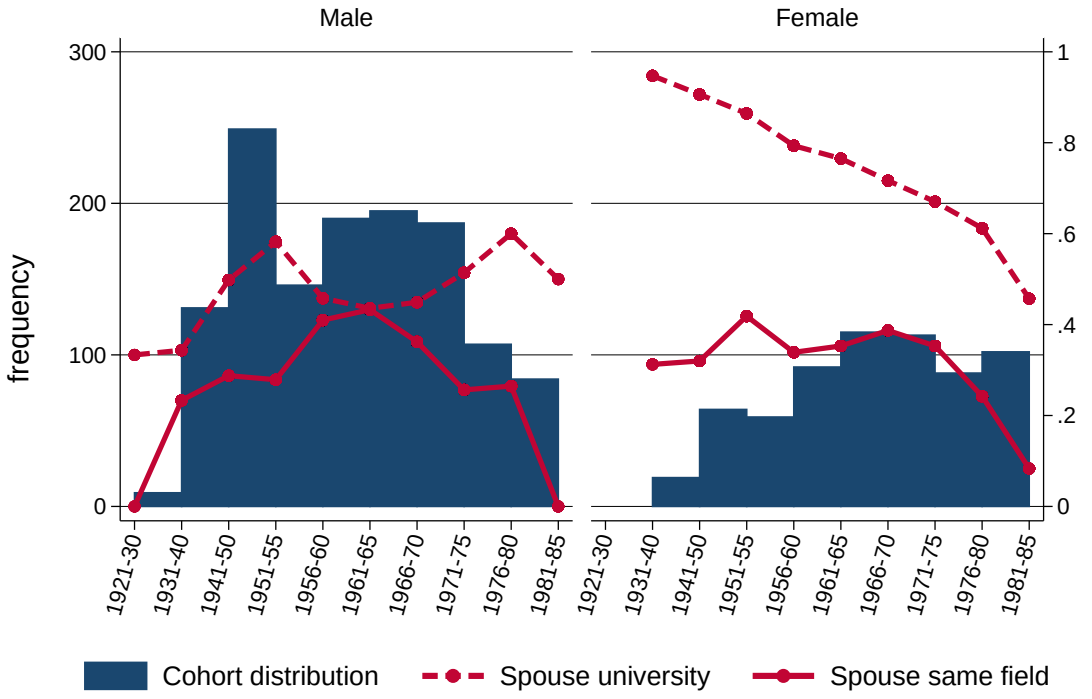

Figure 5: Distribution across cohorts and share of homogamous marriages

4 Results

The results of probit regressions are presented in Tables 1 and 2. I present results for different specifications, which differ with respect to the inclusion of covariates. A basic specification in column (1) of Table 1 only includes a female dummy, the female share and the interaction of both. Column (2) additionally includes the square of the female share and its interaction with the female dummy. Columns (3) to (5) additionally include cohort and field dummies as well as the additional control variables. Throughout the specifications, the female dummy is strongly positive and statistically significant, which means that women are generally more likely married to a partner of the same educational level, which is consistent with previous results that women rather tend to marry up.

The female share has the expected sign and is positive for men, meaning that male students are more likely to marry a woman with university education when the share of females in their peer group is larger. The interaction with gender reveals that the opposite holds form women, which is consistent with the notion that the relatively scarce gender is more likely to marry homogamously. The results for being married to a spouse with a degree in the same field show a very similar pattern. However, they are smaller in magnitude and the main effect of the female share is not statistically significant. Only the interaction with the female dummy is significant.

Figure 6 shows the marginal effects for both outcomes and for men and women separately. The left-hand panel shows the predicted probabilities of being married to a spouse with a university degree. The point estimate for women and a zero female share is 86%, compared to 36% for men, a difference of 50 percentage points. The difference remains statistically significant for females shares of up to 40% (men: 55%, women: 77%) and becomes insignificant for female shares of 50% and above. The right-hand panel of Figure 6 shows the equivalent effects for being married to a spouse in the same field. While the pattern is similar with an initially higher estimated probability of homogamous marriage for women at low levels of female shares (46% compared to 17% for men) and an increasing likelihood for higher levels of the female share, the point estimates are smaller in magnitude and not

significantly different from each other.

Table 1: Probit results: Spouse has a university degree

	(1)	(2)	(3)	(4)	(5)
Female	1.323	1.530	1.512	1.558	1.556
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female share	1.033	1.822	2.245	1.640	2.256
	(0.000)	(0.002)	(0.000)	(0.202)	(0.087)
Female x female share	-1.872	-3.489	-3.355	-3.108	-3.110
	(0.000)	(0.003)	(0.005)	(0.017)	(0.020)
Female share sq.		-1.367	-1.706	-1.591	-2.245
		(0.144)	(0.075)	(0.314)	(0.166)
Female x female share sq.		2.301	2.281	1.685	2.077
		(0.112)	(0.120)	(0.300)	(0.211)
Constant	-0.287	-0.346	-0.598	0.242	-0.003
	(0.000)	(0.000)	(0.172)	(0.717)	(0.997)
Cohort dummies	N	N	Y	Y	Y
Field dummies	N	N	N	Y	Y
Controls	N	N	N	N	Y
Pseudo R^2	0.064	0.065	0.079	0.108	0.123
Log-likelihood	-1248.962	-1247.625	-1230.006	-1183.812	-1163.442
Observations	1950	1950	1950	1936	1936

Note: p-values in parentheses. Controls include the total female share, the log of the total number of students in the field, and binary variables for not being born in Germany and for being from East Germany. Standard errors are clustered on the level of married couples.

Table 2: Probit results: Spouse has degree in the same field

	(1)	(2)	(3)	(4)	(5)
Female	1.185	1.054	1.051	0.926	0.941
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female share	1.536	6.343	6.176	1.795	1.651
	(0.000)	(0.000)	(0.000)	(0.467)	(0.502)
Female x female share	-3.281	-3.633	-3.618	-2.922	-2.851
	(0.000)	(0.001)	(0.001)	(0.036)	(0.050)
Female share sq.		-7.280	-6.906	0.896	1.119
		(0.000)	(0.000)	(0.747)	(0.694)
Female x female share sq.		1.480	1.430	0.649	0.477
		(0.302)	(0.331)	(0.734)	(0.813)
Constant	-0.887	-1.399	-2.389	-3.653	-3.942
	(0.000)	(0.000)	(0.000)	(0.012)	(0.072)
Cohort dummies	N	N	Y	Y	Y
Field dummies	N	N	N	Y	Y
Controls	N	N	N	N	Y
Pseudo R^2	0.048	0.081	0.089	0.109	0.116
Log-likelihood	-498.529	-481.396	-476.288	-436.816	-432.165
Observations	825	825	823	747	744

Note: p-values in parentheses. Controls include the total female share, the log of the total number of students in the field, and binary variables for not being born in Germany and for being from East Germany. Standard errors are clustered on the level of married couples.

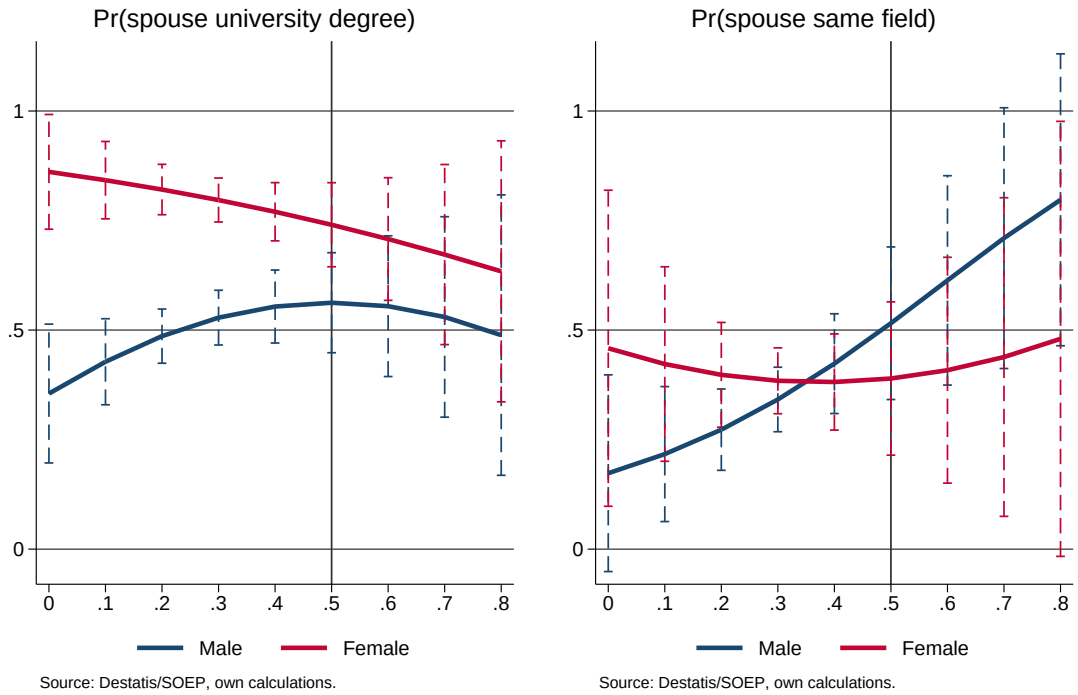

Figure 6: Marginal effects of the female share by gender

5 Conclusions

This paper studies how the gender composition of university students has affected marriage market outcomes of academics in Germany. Specifically, I investigate whether men (women) who obtained a university degree are more likely to be married to a spouse with the same level of education when the female share of students while studying is high (low). For this, I exploit the large variation in the gender composition of students over time and across fields of study in Germany between 1952 and 2012 and combine this information with micro data from the German Socio-Economic Panel (SOEP).

Probit estimations reveal that being enrolled in university education while the female share of students within the field is high is strongly positively related to being married to a spouse with a degree in the same field for men, while the effect is negative for women. Specifically, men have a more than 50 percentage points lower probability marrying a university-educated woman when the female share tends to

zero, controlling for cohort and field effects. For increasing shares of female students, the likelihood of homogamous marriage increases for men, but decreases for women. A similar pattern holds for being married to a spouse with a degree in the same field.

These results indicate that the university campus represents an important marriage market for academics in Germany and are consistent with the notion that the gender composition of the relevant group of peers is crucial for marriage market outcomes and assortative mating specifically. In the next step, I will additionally focus on longer-run outcomes, such as fertility, labor supply and marriage stability.

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Appendix

Table 3: Female share of university students by year

Year	Mean	Sd	Min	Max	N
1952	0.125	0.138	0.001	0.436	17
1953	0.128	0.143	0.000	0.468	17
1954	0.133	0.154	0.000	0.509	17
1955	0.143	0.169	0.002	0.560	17
1956	0.136	0.163	0.002	0.581	21
1957	0.140	0.169	0.000	0.598	21
1958	0.183	0.156	0.000	0.602	35
1959	0.192	0.159	0.000	0.589	35
1960	0.198	0.161	0.003	0.604	35
1961	0.238	0.198	0.003	0.819	39
1962	0.240	0.196	0.004	0.780	39
1963	0.245	0.196	0.005	0.777	39
1964	0.246	0.196	0.004	0.770	39
1965	0.244	0.194	0.004	0.754	39
1966	0.257	0.216	0.004	0.911	40
1967	0.264	0.216	0.004	0.910	40
1968	0.270	0.222	0.004	0.913	40
1969	0.272	0.222	0.005	0.901	42
1970	0.269	0.217	0.006	0.851	42
1971	0.269	0.214	0.006	0.839	42
1972	0.278	0.210	0.008	0.823	42
1973	0.307	0.215	0.009	0.855	44
1974	0.319	0.215	0.002	0.867	45
1975	0.333	0.213	0.002	0.873	45
1976	0.344	0.214	0.005	0.877	45
1977	0.350	0.214	0.007	0.880	45
1978	0.361	0.216	0.015	0.880	45
1979	0.371	0.216	0.012	0.881	45
1980	0.375	0.218	0.012	0.880	45
1981	0.382	0.219	0.012	0.879	45
1982	0.395	0.219	0.019	0.882	45
1983	0.404	0.220	0.022	0.888	45
1984	0.409	0.221	0.026	0.886	45
1985	0.412	0.221	0.026	0.886	45

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... table 3 continued

Year	Mean	Sd	Min	Max	N
1986	0.417	0.222	0.027	0.883	45
1987	0.420	0.224	0.029	0.882	45
1988	0.423	0.224	0.029	0.877	45
1989	0.426	0.224	0.031	0.868	45
1990	0.431	0.224	0.032	0.866	45
1991	0.433	0.222	0.033	0.860	45
1992	0.437	0.221	0.034	0.850	45
1993	0.455	0.212	0.037	0.840	44
1994	0.459	0.210	0.036	0.834	44
1995	0.460	0.209	0.035	0.836	44
1996	0.464	0.208	0.035	0.833	44
1997	0.468	0.206	0.035	0.827	44
1998	0.473	0.206	0.035	0.825	44
1999	0.480	0.205	0.040	0.840	44
2000	0.489	0.205	0.046	0.845	44
2001	0.497	0.203	0.050	0.845	44
2002	0.503	0.203	0.056	0.855	44
2003	0.510	0.203	0.058	0.858	44
2004	0.513	0.203	0.059	0.857	44
2005	0.519	0.207	0.059	0.864	44
2006	0.520	0.209	0.059	0.865	44
2007	0.520	0.212	0.060	0.872	44
2008	0.521	0.213	0.060	0.875	44
2009	0.525	0.212	0.062	0.870	44
2010	0.527	0.211	0.065	0.870	44
2011	0.528	0.210	0.069	0.865	44
2012	0.524	0.210	0.074	0.859	44
Total	0.382	0.235	0.000	0.913	2477

Source: Destatis (1992, 2012).

Table 4: Female share of university students by field

Field	Mean	Sd	Min	Max	N
(1) Languages/Culture	0.663	0.062	0.499	0.819	52
(3) Math/Nat. Sc.	0.350	0.116	0.168	0.503	55
(4) Medicine	0.407	0.121	0.240	0.626	61
(5) Agriculture	0.262	0.167	0.032	0.488	61
(7) Arts	0.613	0.124	0.320	0.757	61
(10) Prot. Theology	0.377	0.193	0.091	0.625	61
(13) Cath. Theology	0.323	0.212	0.010	0.575	61
(17) Dentistry	0.348	0.146	0.160	0.624	61
(18) Vet. Medicine	0.476	0.280	0.042	0.862	61
(19) Pharmaceutics	0.621	0.096	0.436	0.755	61
(20) Law	0.303	0.160	0.083	0.527	61
(21) Economics/BA	0.258	0.132	0.092	0.470	61
(25) Pedagogics/Teaching	0.681	0.069	0.580	0.775	44
(27) Social Sciences	0.455	0.137	0.090	0.600	57
(37) Philosophy	0.341	0.081	0.212	0.437	55
(39) Psychology	0.592	0.120	0.421	0.773	55
(49) History	0.405	0.059	0.283	0.465	55
(51) Librarianship	0.499	0.131	0.263	0.757	55
(58) Ancient Philology	0.449	0.132	0.225	0.615	55
(62) Anglistics	0.653	0.093	0.424	0.730	52
(63) Romance Philology	0.747	0.080	0.571	0.832	52
(67) Slavistics	0.675	0.094	0.469	0.767	52
(74) Dramatic Arts	0.515	0.118	0.220	0.631	55
(75) Musicology	0.445	0.100	0.235	0.550	55
(80) Sports	0.397	0.048	0.287	0.461	61
(85) German Philology	0.623	0.124	0.404	0.765	55
(89) IT Science	0.145	0.022	0.106	0.188	40
(92) Physics	0.108	0.044	0.040	0.195	55
(98) Chemistry	0.272	0.120	0.074	0.455	55
(101) Biology	0.504	0.103	0.330	0.646	55
(104) Geosciences (without Geography)	0.244	0.127	0.040	0.423	55
(105) Geography	0.407	0.081	0.231	0.470	55
(109) Landscaping	0.418	0.126	0.176	0.566	57
(111) Forest and Wood Management	0.129	0.103	0.000	0.298	57
(114) Ecotrophology	0.866	0.022	0.823	0.913	47
(115) Machine Engineering	0.069	0.059	0.002	0.171	61

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... table 4 continued

Field	Mean	Sd	Min	Max	N
(118) Mining and Metallurgy	0.077	0.071	0.004	0.226	61
(121) Architecture	0.312	0.167	0.059	0.573	61
(122) Reg./Spat. Planning	0.308	0.126	0.105	0.470	44
(123) Civil Engineering	0.105	0.090	0.001	0.260	61
(124) Geodesy	0.142	0.122	0.000	0.309	61
(128) Design	0.559	0.048	0.432	0.613	40
(133) Traffic Engineering	0.022	0.013	0.002	0.039	19
(137) Elec. Engineering	0.026	0.021	0.001	0.074	61
(141) Engineering Economics	0.090	0.071	0.004	0.212	57
Total	0.382	0.235	0.000	0.913	2477

Source: Destatis (1992, 2012).