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Parental qualifications as determinants of university entrance and choice of a field of study in Germany

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ABSTRACT

Against the background of Bourdieu's reproduction theory, the choice of field of study was addressed above all as topic of social inequality in tertiary education. It was supposed that 'title inflation' led to a relocation of the distinctive advantage of the upper classes from the vertical to the horizontal dimension of inequality in the choice of field of study. Previous studies only showed a weak effect of social background on the choice of medical and legal studies. However, what had not before been analysed was the continuation of family traditions in academic and non-academic fields, which operate as mediator between social origin and the choice of field of study. The present study analyses this connection with a newly developed instrument from the German Student Survey, which is conducted by the Research Group on Higher Education at the University of Konstanz. As a result, it can be shown that the father's education has only a weak effect on the student's choice of field of study. However, the probability of a similar choice of field of study increases between 10% and 20% if the familial training traditions are considered.

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1. Reproduction theory of Bourdieu and determinants of choice of field of study

The differences and inequalities regarding university entrance and the choice of subject have been a main topic of the social sciences since the sixties of the last century. The following criteria and conditions have been of interest: gender, disability, migration background, religion, biographical situation as well as regional recruitment, ethnic belonging, or social origin. The question of female discrimination at universities and in different subjects has been intensively investigated, beginning with a survey about female pupils (Gerstein 1965), followed by trend surveys about the development of women at universities (cf. Ramm and Bargel 2005) and comparative results with an international perspective (cf. Grimmer and Röhl 2005), to a scientific and politically important debate about the equal chances of women at universities and polytechnics as a task for gender equity and quality management (Esch and Herrmann 2008).

The following contribution is embedded in reproduction theory as developed by Bourdieu (Bourdieu 1983, 1988). An important point of this theoretical approach concerning

the social structure of society and its determinants is the conviction that a society's social structure cannot be described solely on the basis of social arrangements in the context of their hierarchical structure and its reflection in respective socio-economic conditions. This representation must be supplemented by information about the socio-cultural aspects of different mentalities in society. This is what is ultimately responsible for creating different social milieus and lifestyles within social strata or classes. Bourdieu focused on the vertical and horizontal differentiation and definitions of social structure. To analyse them, he introduced the components of economic (financial resources), social (prestige), and cultural capital (lifestyle) (Bourdieu 1983). These components are decisive for the outer boundary and internal cohesion of social milieus and the distinctions between them, as well as their continuity and reproduction. In addition, to the achieved level of education and occupational position also has occupational affiliations, whether for a particular course of study or for occupational embedding (Bourdieu 1988).

Discussions of the reproduction of social inequality have frequently addressed the social backgrounds of students and their choice of a field of university study. The choice of a field of study is very important, because the social backgrounds of students are linked to their future social positions. This is an extremely important juncture in their individual biographies, as well as in social reproduction (Preisser 2003). It is therefore reasonable to define the determinants or factors of this process and to clarify the respective strength of their influence – the main task of this contribution.

To understand the relationship between the social backgrounds of students and their choice of a field of study, two components must be related, following the theoretical propositions of Bourdieu. First, the social situation and the cultural milieu of the family home, and second, the affiliation with different fields of study at university, and thus the culture of academic discipline that characterizes these fields (cf. Liebau and Huber 1985). Bourdieu justified these interdependencies of university enrollment and the choice of a field of study by classifying fields of study hierarchically according to the social backgrounds of students and by relating them to the prestige of academic disciplines and professions (cf. Bourdieu and Passeron 1971). Thus, prestigious and traditional fields of study such as medicine and law are chosen by a far greater proportion of students from higher status social backgrounds, in particular the children of university graduates, as compared to the social sciences, humanities, and education (which have the lowest prestige). The latter contains a disproportionately large number of students from the lower social strata (Bourdieu 1982).

The findings about a socially selective choice of academic discipline have been repeatedly confirmed in different surveys in Germany, to an almost equal extent and with almost the same gradations (cf. Simeaner, Ramm, and Kolbert-Ramm 2010; Heine 2012). At first glance, the distribution of students of different social origin in the different subject fields appears quite clearly. If, however, the effectiveness of different factors of social and individual types is examined with regard to the choice of an academic discipline, then the influence of social background on this choice remains low at the university level, and individual motivational factors are found to be more significant (Windolf 1992).

In this respect, the 'social reproduction theory' of the choice of field of study, based on social characteristics such as social origin or gender, can be set against 'individualization theory', which includes motives, expectations, and attitudes in the decision-making process. The first findings clearly demonstrate the far greater weight of individual

orientation than of social characteristics in the choice of an academic discipline (cf. Georg 2005).

Nevertheless, not only the vertical gradation in which students are classified depending on their family background and the horizontal spectrum to which they belong depending on their parents' academic (university) disciplines are crucial for students' orientation and self-image. Also important is the academic level of their parents' fields of study, and whether they completed professional training. This horizontal differentiation according to the parents' professional training, although sometimes discussed, long remained without empirical support since there were no suitable instruments for data acquisition. This issue has some theoretical importance, as evidenced by the question of whether a student's family status is more important for the choice of a field of study than the parents' professional affiliation.

The following contribution focuses therefore on a central point concerning the reproduction of society's social structure. It considers the social heritage of students, meaning the general status and professional qualifications of their parents, as a determining factor in university entrance and the choice of field of study. In the context of reproduction theory, we question the dependencies between the education of parents and that of the students, not only concerning the academic level, but also concerning the field of study or professional qualification. In addition we also ask whether vertically hierarchical gradations of a socio-economic nature are more significant than horizontal-spectral distributions of socio-cultural provenance for social reproduction. This task requires a profound and representative set of data concerning the student's social origin and also adequate procedures of multivariate data analysis, both of which are explained in Section 2. Then the results are presented in three steps, following our research questions. First, we present the descriptive results about the *distribution* of students with different social origin in different fields of study. Second, we depict the *dependencies* of the students' choice of field of study in the sense of 'social heritage' (educational field of parents), also considering possible difference by gender. Last but not least, we present findings about the *influence* of different, selected factors of social and individual aspects of the students (multivariate modelling). At the end we summarize the results, especially of the multivariate analysis, and discuss some theoretical and practical implications.

2. Method

For reliable answers to our questions we are in need of a good database and an adequate analysis technique. The data are from the German Student Survey, which started in the 1980s and is conducted in our responsibility (Georg and Bargel 2012); it is briefly explained in the following Section (2.1). The multivariate analysis technique is based on a modelling of the factors of social and personal character, following the propositions of Mood (2010); this is explained in Section 2.2.

2.1. The German students survey

We use a special database: the German Student Survey. This survey offers representative data about German students using indicators and questions which are in some respect oriented to the theoretical considerations of Bourdieu's reproduction theory. The rather

long questionnaire of this inquiry follows the methodology of surveys with written questions and items as indicators.

Since 1982, this student survey has been conducted every two or three year at universities and universities of applied sciences throughout Germany. It is part of continuous social monitoring, an effort to collect data in a highly representative way about the experiences of students in higher education and about students' perspectives on study, work, and politics (cf. Peisert, Bargel, and Framhein 1984, 1–9). The contents of this survey refer to a wide range of topics, for example, access to higher education, the choice of professional training, and expectations within disciplines about learning and work habits, as well as the teaching situation and quality, academic difficulties and workloads, and even proposals to improve study conditions. It also contains questions about career choices and career goals, labour market estimates, as well as social and political attitudes about alternative opinions and democratic convictions.

The selection of students for the survey, is made in two steps. First, there is a structured selection of the universities and universities of applied sciences by state, year of foundation (traditionalism), and the range of academic disciplines offered. From the German students of these universities, the choice of all participating students is made by random selection, for which the range has been specified. These students are contacted by the universities and are invited to participate; they receive a written questionnaire by letter. The completed questionnaires are then returned anonymously to the AG Hochschulforschung at the University of Konstanz.

The high number of students surveyed is not only intended to ensure a largely representative picture of the student body at universities and universities of applied sciences, but also to provide the possibility for sophisticated analyses based on gender, social origin, occupational affiliation, performance and success at their studies, or differences in orientations, motivations, and expectations. This allows for different theoretical concepts or assumptions that can be shown in models and explained in variance analysis. These capabilities are especially important for issues of access to higher education and the choice of a field of study (Georg 2005; Multrus 2006).

Because there had previously been no such question, we have developed a new question and list concerning this topic (cf. Bargel, Multrus, and Ramm 2005). To capture the 'parental occupational tradition' of students, according to the correspondent field of professional education or their field of study, some additional work was needed. This also explains why this determinant of the choice of a field of study was previously scarcely considered empirically. Despite all the discussions of 'social heredity' regarding the choice of a field of study at university, there was no question with which the professional or occupational training of parents (father or mother) could be selected from a list of choices. To develop a suitable tool, three decisions had to be made. (1) The question is asked in a closed format, with the character of a survey, using a list from which to select a relevant field of study. (2) The list contains two groups of disciplines, one group for those who graduated from a university or university of applied sciences, another group for other degrees, or occupations requiring formal training (apprenticeships). (3) The fields are divided into nine areas on two levels, which are constructed analogously to the reported disciplines of the students, in order to more clearly identify the interconnections.

While the requirements for identifying parental occupational affiliations at the university level were quite simple, based on the names of disciplines such as those used in the

official statistics for ‘occupations requiring formal training’, making analogous designations and adding examples (set in brackets) was far more complex. Additionally, for the sake of comprehensibility, the fields of agricultural science, forestry, and nutritional sciences had to be categorized in two genres on the level of occupations requiring formal training. However, these genres are usually merged again during analysis. The list presented to the students to determine their parents’ professional affiliation or education finally included 23 alternative choices (cf. Figure 1).

The new question and the developed list of parental occupational qualifications were first introduced to the survey in 2003/2004. Initial findings were presented in 2006 on ‘Family traditions of professions among students’ (Multrus 2006) and the conclusions in terms of such an influence on the choice of a field of study were satisfactory (Multrus 2007). Given the positive results, the question was included in subsequent surveys and used accordingly. Thus, the data from a series of four surveys at three-year intervals between winter semester (WS) 2003/2004 and WS 2012/2013 are currently available.

As a database for further analysis, three student surveys are used, namely the surveys taken in WS 2006/2007, WS 2009/2010, and the last one taken in WS 2012/2013. The transition to a two-stage degree structure consisting of undergraduate bachelor and master degree programmes took place at German universities during this phase. Master degree students are excluded in the analysis of the choice of academic field, since after further selection they enter a second study stage. Thus, all study programmes are included which lead to the undergraduate bachelor degree or a state examination (such as law or medicine). Additionally, the analysis deals only with students attending a university, as this type of educational institution offers the entire range of academic disciplines. The underlying selection of students is defined as an ‘analysis sample’. In the previous three instances of the survey, the participants consisted of a total of 14,645 students at universities (WS 2006/2007: 6461; WS 2009/2010: 5401; WS 2012/2013: 2783).

2.2. Analysis techniques

To determine the correlation between academic heritage and choice of a field of study in the narrower sense, two responses of the surveyed students are drawn on. First, the answer concerning the subject area of the father’s professional training, and second the answer concerning the student’s own academic discipline affiliations in the first programme of study. The possible responses are analogously structured so that the parental academic discipline, as well as the student’s own academic discipline affiliations can be directly related to each other on a grouped level.

In addition to the important social-structural variables, two additional factors are included: the respondents’ *gender* and their *level of performance*, determined by the average grade achieved on the higher education entrance exam (grouped). Students’ migration status (whether they or their families immigrated to Germany) is not taken into account, because this data has not been collected. The analysis is carried out for *seven fields of study groups*, whereby medical studies serve as a reference discipline.

To investigate the probability of the choice of the field of study having dependence on vertical (father’s education and training) and horizontal (father’s area of professional training) characteristics of origin, a multinomial logit model was estimated using

List 2

Areas of parents' professional education

(Please indicate the type of occupation/profession of your father and mother.)

If:	If:
Degrees/Graduation from Universities/Universities of Applied Sciences	Other Degrees/Occupations requiring formal training
01 Humanities / Social Sciences and Theology, Languages	11 print media, electronic media, librarianship, foreign languages (e.g., journalism, publishing, librarianship)
02 Social Sciences and Education Pedagogy, and psychology	12 Education and social services (e.g., nursery school teacher, social service provider, youth services)
03 Legal Studies	13 Administrative, legal, security (e. g., paralegal, police, corrections, air traffic controller)
04 Economics and Industrial Engineering	14 Commercial sector / trade / banking (e.g., Administrative assistant, actuary, trade association)
05 Medicine, Dentistry and Veterinary Medicine, and Pharmacy	15 Health Care, Nursing, optometry, pharmacy (e.g., medical assistant, medical technician, opticians, dental technician)
06 Natural Sciences, including Mathematics, Computer Science	16 Natural Science Sector (e.g., Chemical laboratory assistant, laboratory assistant)
07 Engineering and Architecture	17 Technology, Metallurgy, and Electronics, Building, Timber/Lumber Industry, IT (e.g., locksmith, mason, mechanic, electrician)
08 Agronomy, Forestry and Nutritional Science	18 Nutrition, Gastronomy/Hotel And Catering (e.g., Baker, Butcher, Cook, Waiter)
09 Fine Arts, Music, Theater, Film school	19 Agriculture And Home Economics, Horticulture (e.g., Gardener, Florist, Agricultural Manager)
10 Other disciplines	20 Fine Art, Design, Music Sector (e.g., Photographer, Interior Decorator, Couturier)
	21 Other Occupations
	22 No professional training
	23 Don't know

Source: Student survey 2004 – 2013, AG Hochschulforschung, University of Konstanz

Figure 1. List of choices for parents' occupational affiliations from the student survey (WS 2003/2004 to WS 2012/2013).

STATA, version 13.1. In addition to the above areas, the grade on the higher education entrance examination and the student's gender are included in the model as control variables.

The usual approach to the sociological analysis of social inequality is to calculate logit models and the corresponding odds ratios to report on social strata. However, it has been

argued (Mood 2010) that this method can lead to distorted or even false interpretations of the results. Following Mood (2010) and Allison (1999), there is, in addition to the problem of incorrect specification due to the omission of unknown and correlated predictors in linear regression, a source of biased results in the non-linear logit and probit regression which is caused by unobserved heterogeneity.

If a latent continuous variable y^* is assumed to be measured by a manifest dichotomous variable y , we arrive at the following standard formulation of the logistic model:

$$y^* = \alpha + x_1\beta_1 + \varepsilon \quad (1)$$

In this context, one has to accept a specific distribution of the error term, which is defined in the case of the logistic model as a fixed variance: $\pi^2/3$, that is, 3.29. Since there is a total variance of y^* in the explained variance and the (fixed) residual variance, an increase in the explained variance will increase the total variance and thus the scale of the dependent variable. As a result, β depends not only on its relationship with y^* , but also on the extent of unobserved heterogeneity in the model (Mood 2010, 69). However, this means that the comparison of log odds and odds ratios across samples, groups, times, or hierarchical models may be distorted by the circumstances outlined above.

Mood (2010) offers several solutions for this problem. In addition to the proposal to use linear probability models that are not affected by this distortion or the y -standardization of the coefficients, she refers to measures that relate to changes in probabilities. These marginal effects can be calculated by using the first derivative at a specific point of X (normally the mean), in that all other variables are held constant. On the other hand, the average effects can also be calculated from x by first determining a logistic distribution for each case, multiplying it by the coefficient for each variable, and then calculating the average of all cases (Bartus 2005):

$$AME = \beta_i \frac{1}{n} \sum_{k=1}^n f(\beta x^k) \quad (2)$$

Hereby β_1 is the estimated coefficient for the variable i , f is the derivative of the cumulative distribution function with respect to βx^k , and βx^k denotes the value of the linear combination of parameters and variables for the k -th observation.

This so-called average marginal effect (AME) measures the average change in y when the corresponding independent variable increases by one unit, while all other variables remain constant. For dummy variables, the AMEs change in the dependent variable for Category 1 in comparison to the reference group (Bartus 2008). Mood (2010, 80) shows that AME coefficients can be used for comparisons between groups, sampling, and points of time. If, for example, in the first column of Table 4(a) the coefficient for 'father's discipline humanities' is .12, this means that the probability of a student choosing the same field of study as his father is 12%. While in cases of log odds or odds ratios these coefficients have to be interpreted in relation to the reference category, this is not the case with AMEs. An AME only indicates the probability change for the respective category. For that reason, AMEs can also be computed for the reference category of the multinomial logit model.

In order to assess the fit of the overall model, we had to draw on McFadden's pseudo R -squared. However, it is known from simulation studies that the true explanatory power of

the model is significantly underestimated by this measure (Veall and Zimmermann 1994; Lange 2000). In this context, the variance-based determination of McKelvey and Zavoina (1975) has proved to be the best measure for the model adjustment in logit models (Snijders and Bosker 1999, 225). These coefficients cannot be calculated for the overall model, but rather only for the various alternatives. This means that a multinomial logit model was estimated with the reference category medicine, however, as can be shown statistically (Lange 2000), the pseudo *R*-square of McKelvey and Zavoina of each single alternative can be computed by a logit model with the reference medicine. Since a cluster sample is used in the German Student Survey, robust standard errors were used for the analysis.

3. Results

Section 3.1 describes the distribution of students with different social characteristics and origin in the fields of study. In Section 3.2, we look for the correspondences between father's education, his academic level and field of qualification, and the student's field of study, son or daughter, as preliminary insights in social dependencies in sense of social heritage. Finally, the results of the multivariate analysis about the influence of different social factors on the student's choice of their field of study are presented in Section 3.3.

3.1. Distribution of students with different social characteristics in the fields of study

The starting point is the chosen field of study at a university, which are grouped according to seven field of study areas, namely: humanities, social sciences, law, medicine, natural sciences, and engineering (according to the statistical procedures used). The distribution of students according to the combined social-structural characteristics of gender, performance status, parental educational level, and their occupational affiliation can be summarized as follows: for each of the seven defined areas of study, there is a discernible relationship to social background characteristics, but in a differentiated manner. This shows that each produces different proportionalities in comparisons of discipline affiliations. Sometimes this is characterized as stronger, sometimes as only very weak (cf. Table 1).

As for the genders of the students surveyed, we know that in this period more women than men attended university, where their participation in the survey was slightly above average compared to official statistics. Thus, in the analysis sample for the last three surveys, the share of female students was 58.5%. In three disciplines, the number of women is higher than that of men: in cultural and linguistic studies, the social and educational sciences, and in medicine, especially in veterinary medicine. Women are generally enrolled in economics and the natural sciences as often as men (in spite of variations in individual fields of study, such as biology or physics). Women are far less likely to be enrolled in engineering programmes, where only a quarter of the students are female. The preference for particular fields of study is strongly correlated with gender. While quantitatively women dominate in some disciplines, men dominate in others. This is even more pronounced on the level of individual fields of study (cf. Table 1).

In terms of demonstrated school 'performance level,' overall a little more than a third of the students can be considered 'outstanding students' based on their grade reports in

higher education (36.3/35.1%). The distribution of performance levels for access to higher education, that is, achieved grades on the higher education entrance examination (Abitur or secondary school final examination), usually do not vary greatly between disciplines. One exception is the field of medicine, which shows a great difference. Here, over two-thirds of students are 'outstanding' (with an average grade of 1.0–1.9, on a scale of 1–6). Additionally, the proportion is also above average in the natural sciences, where four out of 10 students fall into this group. In all other fields, the proportion of students with a very high achievement level is one-third, according to grades on the higher education entrance examination. A somewhat lower proportion can be observed in the cultural sciences, for example, 28.2%/29.5%, but also in economics and engineering, where the share is slightly higher, with 28.5%/31.3% and 29.6%/31.4% (cf. Table 1).

As expected, the students are distributed among the different disciplines according to their social background. At universities, half of the students come from an academic family home: 49.5%, with 38.4% having a father who graduated from university (cf. Table 1).

The highest level of 'academic reproduction' is still seen in the field of medicine, where two-thirds of students come from an academic family home; this is far higher than in other academic disciplines. A large proportion of students whose fathers have a high level of qualification can also be found in the field of law (traditionally) and in engineering (recently), in each case just over half (51.0% and 53.0%, respectively). Apparently, in recent years there has been a distinct change, particularly in engineering, since there the proportion of students with academic origins, at 41.4% (WS 2006/2007) to 53.9% (WS 2012/2013), has greatly increased. Thus, the engineering sciences at universities have changed from a field of study for students using education for purposes of social mobility to a discipline mostly for children from families with an academic background.

3.2. Correspondence between the educational fields of students and of their fathers

If students' professional affiliations are correctly compared with their fathers', further results concern the distribution of fields of study. Therefore, it is shown which fields of

Table 1. Enrollment in fields of study at universities according to gender, performance status, social background status of students (excluding master programmes) (Percentage for reported social characteristics; $N = 14,645$).

	Gender (Females)	Performance status (Grades 1.0–1.9)	Status of origin (University Degree)
Field of Study			
(01) Cultural Sciences, Languages	72.0	28.2	46.2
(02) Social and Educational Science	74.9	3.4	44.2
(03) Legal Studies/Jurisprudence	63.3	34.3	51.0
(04) Economics	48.4	8.5	45.8
(05) Medicine, Dental	71.9	68.3	67.1
Veterinary Medicine			
(06) Natural Science, Mathematics	47.5	40.4	48.4
(07) Engineering, Architecture	27.6	29.6	53.0
Overall at Universities	58.5	36.3	49.5

Source: Student survey 2007–2013, AG Hochschulforschung, University of Konstanz.

study were chosen by the fathers of the surveyed students. In this context, the data reflects the last three surveys 2006/2007, 2009/2010 and 2012/2013, as well as the total numbers that support the modelling (cf. Table 2).

It is apparent that over half of all surveyed university students (53.2%) chose a programme of studies in their fathers' academic discipline, while no more than 43.3% chose a different degree or vocational training programme than their father. Comparing the three surveys between 2006/2007 and 2012/2013, we see that a certain shift has occurred. The range of students with a father who has a degree from a university or a university of applied sciences (institute of technology) decreased slightly during this period, that is, from 54.9% to 50.4%. In contrast, the proportion of fathers who have completed professional or vocational training increased from 40.9% to 46.2% (cf. Table 2).

In most cases, the students' fathers pursued a technology or engineering degree, whereby this technology or engineering field of study is represented among the non-academic ones (non-university studies) with a total of 24.4%, more frequently than among academic ones (university studies), with 18.9%. With a clear difference, study areas at an academic (university) level follow with rates of between 5% and 8%, such as the social sciences (5.9%), natural sciences (6.2%), and medicine (6.4%). The commercial sector at the non-academic (non-university) level represents 7.4%. A number of fathers' study areas are represented with less than 1% of students. These all belong on the non-

Table 2. Discipline affiliation of university students' fathers: overall and in the survey data 2006/2007, 2009/2010 and 2012/2013 (not including master programmes) (percentage).

	Total	in ...		
Discipline affiliation of father	(14,645)	WS 2006/ 2007 (6461)	WS 2009/ 2010 (5401)	WS 2012/ 2013 (2783)
ACADEMIC: University, University of Applied Sciences Degree				
(01) Humanities/Social Sciences	3.2	3.5	3.1	3.0
(02) Social and Educational Science	5.9	6.8	5.4	4.8
(03) Legal Studies	3.5	3.2	4.0	3.1
(04) Economics	4.5	4.6	4.4	4.3
(05) Medicine, Dental, Veterinary Medicine	6.4	6.8	6.1	5.8
(06) Natural Sciences, Mathematics	6.2	6.3	5.8	6.4
(07) Engineering, Architecture	18.9	19.0	19.1	18.2
(08) Agronomy, Forestry and Nutritional Sciences	2.1	2.1	2.0	2.2
(09) Fine Arts, Music, Theatre, Film school	1.0	1.0	1.1	1.1
(10) Other disciplines	1.5	1.6	1.3	1.5
Total: University Graduates/Degrees	53.2	54.9	52.2	50.4
Other Degrees/Occupations requiring formal training				
(11) Print, Electronic Media, Library Science	0.8	1.0	0.8	0.8
(12) Education, Social Services and Social Care	0.3	0.4	0.2	0.4
(13) Administration, Legal, Security	3.1	2.9	3.0	3.7
(14) Commercial sector, Trade, Banking	7.4	7.7	7.2	7.1
(15) Health Care, Nursing, Optics	1.2	0.9	1.3	1.6
(16) Natural Sciences (Laboratory)	0.6	0.7	0.6	0.6
(17) Technology, Metallurgy, Electronics, Construction Industry	24.4	24.1	24.8	24.4
(18) Nutrition, Gastronomy/Hotel, Baker	2.9	2.7	3.0	3.1
(19) Fine Arts, Design, Musical Studies	0.2	0.0	0.3	0.4
(20) Other occupations	2.4	0.5	3.7	4.1
Total other degrees/diplomas	43.3	40.9	44.9	46.2
(21) No professional training	2.0	3.2	1.1	1.3
(22) Don't know	1.5	1.0	1.7	2.1
Totals	100.0	100.0	100.0	100.0

Source: Student Survey 2007–2013, AG Hochschulforschung, University of Konstanz.

academic (non-university) level, such as the print and electronic media professions (0.8%), education and the social services sector (0.3%), the natural sciences and laboratory sciences sector (0.6%), as well as the areas of fine arts, music, and design (0.2%).

It is now crucial to answer the next question, of whether such distributions will clearly show dependencies on the parents' fields of study. For this purpose, it is necessary for the individual field of study areas (here seven) to include and compare the distribution of the fathers' academic origins (here 20). If there is such a dependence related to the field of study, then in the respective academic disciplines there should be significantly more students whose fathers pursued the same field of study. This relationship becomes apparent when the diagonal of the father's professional training is the student's choice of academic discipline (cf. [Table 3](#), where the corresponding values are printed in boldface). At the same time, it would be revealing to know whether the academic level of professional training has more consequences for social inheritance compared to the non-academic (non-university) training level.

On the level of academic degrees, the educational inheritance is given by fathers to children in all seven fields of study, because the proportion of students in analogous academic disciplines is clearly disproportional (bold values in [Table 3](#)). If the distance to the next higher proportion is calculated, the extent of field of study reproduction becomes clearly visible. It is particularly high in medicine, with 22.3% of the fathers also having pursued medical studies. Less pronounced is the range and difference from the next value in the humanities and in social and natural sciences. Here, although an over-proportional representation of an academic (university) discipline analogous to that of fathers is noted, children with a father in this field of study chose another field more often and sometimes to an almost similar extent.

On the non-academic (non-university) level of education and professional training, such a consistent association between father and child cannot be detected. Although in some disciplines such a relationship is quite often present – such as in the areas of technology and print, electronic media, and library science – here it is comparatively low. If the father had professional training in the commercial sector, then studies in fields such as economics are pursued almost equally often. If the father pursued studies in the natural sciences, studies in the humanities or legal studies will additionally be chosen just as disproportionately often. Also different is the choice of a field of study when the father had professional training in the health care sector. In these cases, the study of medicine is not likely to be considered, but rather these children can be found in the fields of law or natural science.

Overall, the field of study choice inheritance in an academic (university) field chosen by the student's father is far more pronounced in all disciplines than in a non-academic (non-university) training programme. For entry into university education and the choice of a study field this is far less binding. The professional characteristics of inheritance from the father to the child attending a university is strongest in the field of medicine, followed by studies of law and engineering. Apparently, the academic professions of fathers have a greater attraction for their university-attending children, and their professional activities are far more likely to be considered as exemplary.

It is also noteworthy that some fields of study are rarely considered or selected if the father has completed a particular professional training. For example, if the father is an engineer or architect, his child seldom enters the field of law; if the father is a medical

Table 3. Occupational discipline of the students' fathers according to fields of study of students at universities (Total for 2006/2007, 2009/2010 and 2012/2013) (percentage).

	Field of study – Students							
	Total (14,332)	Cultural studies (3352)	Social sciences (2103)	Law (811)	Economics (1715)	Medicine (1562)	Natural science (2968)	Engineering (1821)
Field of Study Father ACADEMIC: University, University of Applied Sciences Degrees								
(01) Humanities, Cultural studies	3.2	5.4	2.9	3.4	2.1	3.0	2.8	1.6
(02) Social and Educational Sciences	5.9	6.6	8.7	3.9	5.1	6.3	4.6	5.3
(03) Legal studies	3.5	3.7	3.4	9.8	3.8	2.7	2.8	2.0
(04) Economics	4.5	4.2	3.8	6.4	7.9	3.9	4.1	3.3
(05) Medicine, Dental, Veterinary Medicine	6.4	4.5	4.4	6.2	3.4	22.3	4.6	3.6
(06) Natural Sciences, Mathematics	6.2	4.7	4.2	5.7	4.8	6.9	9.5	6.2
(07) Engineering, Architecture	18.9	17.4	16.0	12.3	18.0	18.3	18.8	28.8
(08–10) Other academic disciplines	4.6	5.0	4.5	3.9	4.5	4.4	4.5	4.2
Total of University Graduates	53.2	51.5	47.9	51.6	49.6	67.8	51.6	55.0
OTHER DEGREES/DIPLOMAS – Occupations requiring formal training								
(11) Print, Electronic Media, Librarianship	0.8	1.2	1.1	0.9	0.5	0.7	0.9	0.3
(12) Education, Social Services, Social Care	0.3	0.3	0.3	0.1	0.4	0.1	0.2	0.2
(13) Administration, Law, Security (police, military)	3.1	3.3	3.1	3.2	3.5	2.1	3.4	2.8
(14) Commercial sector, Banking	7.4	7.5	8.2	10.0	9.4	6.3	6.5	5.8
(15) Health Care, Nursing, Optics	1.2	1.3	1.3	2.0	1.0	1.0	1.1	0.7
(16) Natural Science, Laboratory assistant	0.6	0.6	0.6	0.8	0.7	0.5	0.6	0.4
(17) Technology, Metallurgy, and Electronics, Construction Industry	24.4	23.6	26.8	21.5	25.1	16.7	26.2	27.6
(18–20) other occupations requiring professional training	5.5	6.1	6.4	5.6	5.9	3.6	5.5	4.3
Total of other degrees/ diplomas	43.3	43.9	47.8	44.1	46.5	31.0	44.4	42.0
No professional training, don't know	3.5	4.6	4.3	4.3	3.9	1.2	4.0	2.9
Total	100.1	99.9	99.9	99.9	99.9	101.1	99.9	99.9

Source: Student Survey 2007–2013, AG Hochschulforschung, University of Konstanz.

professional or humanities scholar, his children are unlikely to study economics. If the father is a lawyer, his children seldom pursue a degree in the natural sciences. It is clear, as in other examples, that the process of reproduction is determined not only by relationships and by attractiveness, but in many cases also by rejections and distinctions.

3.3. Influence of social characteristics on students choice of field of study

The following tables show the results of the described analytical procedures for the relevant disciplines at universities: from the fields of the humanities and social sciences, to

economics, and to natural science and engineering, whereby the study of medicine always serves as a reference point. For the variables (factors) of the model such as gender, grades on university entrance examinations (Abitur or high school final examination), social origin (in 6 ordinal stages), and especially for the 14 categorical fields of study of fathers, the probability is shown for each variable (respectively by how much the probability is higher or lower), that it is the specific factor that determines enrollment in this field of study.

According to this, gender is of greater significance when pursuing studies in the humanities or social sciences, as well as in engineering. However, in the latter field it is significant with a negative prediction. In contrast, the influence of gender is negligible for the field of law. University entrance examination grades exert a greater influence only when the chosen study programme is medicine. For all other disciplines, these grades have little influence, meaning that their effectiveness remains one-sided. At the university level, the father's educational attainment has consistently little influence on a student's choice of a field of study: the fact that a father has a university degree does not indicate that his child chose or avoided a certain field of study to a greater or a lesser extent. A degree in medicine or engineering has a somewhat disproportionately lower probability of being pursued.

The last line of the [Table 4](#) for multinomial regression of the choice of a study field states the pseudo *R*-squared in reference to the study of medicine. It is highest for engineering (.38) and lowest for legal studies (.18). Thus, the four social characteristics (gender, performance status, status of origin, and inheritance of the field of study) determine the decision for engineering programmes to a very large extent. However, the choice of studies in law (in reference to medical studies as well) is determined only to a low degree. The total value does not indicate how much the weight of each factor contributes.

The alternative specific explanatory power of the models (with the reference category medicine) indexed by McKelvey and Zavoina's pseudo *R*-squared is on average 26%: ranging from 38% for engineering to 18% for legal studies. This clearly shows, as is also found in simulation studies (Veall and Zimmermann 1994), that the real context is significantly underestimated by McFadden's *R*-squared.

The probability that students will choose programmes in the humanities increases by 10%, and per 'worse' grade it rises by 5%. The father's education or professional training as the vertical inequality dimension exerts no influence on the choice of a study field in the humanities. However, the probability increases to 12% if the father has also pursued a degree in these fields of study. A non-university education in a technical field has a negative effect (−.03) on the choice to study a field in the humanities.

Even more clearly than the humanities, the social sciences are widely viewed as 'feminine' fields of study (13%), and the choice of the social sciences becomes increasingly likely with each decrease in grade on a university entrance examination (3%). The preference for this professional focus is reduced by 3% when the father has attended a technical school, with or without having passed university entrance examinations. In the case father has studied social sciences, it increases by 9%.

In contrast to the previous field of study groups, for female students, studying law is only probable to a limited extent (2%). However, here an 'avoidance effect' is noticeable, if, for example, the father pursued studies in the social sciences (−3%) or engineering (−4%). The intra-familial tradition of this study field tradition is 9%.

Table 4. Multinomial regression of the choice of a study field depending on gender, grades on a university entrance examination (Abitur or high school final examination), father's education, as well as the field of study of the father's occupational affiliation (AMEs, robust standard errors).

Variable	Humanities	Social sciences	Law	Economics	Medicine	Natural sciences	Engineering science
Gender (female)	.10***	.13***	.02*	-.04***	.06***	-.10***	-.17***
Grade – General higher education entrance examination	.05***	.03*	.001	.03*	-.10***	-.04***	.02
Father's qualification level: Secondary school/apprenticeship (Reference)							
Middle School/apprenticeship	.03	-.02	.003	-.01	<.001	-.02	.02
Supervisor (High School and Middle School)	.01	-.01	-.001	-.001	.01	-.01	.01
Technical College and/or general qualification for university entrance	.01	-.03*	-.001	-.01	.02	-.01	.02
University of Applied Sciences	-.06	-.12	.004	.04	-.13**	.06	.21
University	-.01	-.05	.02	-.01	.03	-.02	.04
Father's academic (university) discipline:							
Humanities	.12**	.01	.002	-.05**	.003	-.03	-.06*
Social Sciences	.04	.09***	-.03*	-.03**	.03	-.07**	-.02
Law	-.004	.03	.09**	.001	.003	-.06	-.06**
Economics	-.02	-.01	.01	.08***	.008	.04	-.03
Medicine (Reference)	-.03	-.03	-.01	-.05***	.26***	-.06**	-.07**
General Sciences	-.04	-.03	-.02	-.04*	.01	.10**	.005
Engineering	-.02	-.02	-.04***	-.01	.03	-.03	.09***
Print/Electronic Media	.01	.004	.02	-.07*	.05	<-.001	-.02
Social Services sector	.01	.03	-.02	.13	-.06	-.03	-.05
Administration	-.01	-.003	-.01	-.01	.002	.02	.01
Commercial sector	-.03	.001	.01	.02	.03*	-.03**	-.004
Health Care sector	.01	.01	.06	-.03	.03	-.03	-.05
Natural Science sector	.01	.05	.004	-.02	-.01	.01	-.04
Technology	-.03*	-.01	-.01	-.02	.005	.003	.05***
McKelvey & Zavoinas pseudo <i>R</i> -squared for each alternative	.25	.24	.18	.29	Reference	.21	.38
McFadden's <i>R</i> -squared overall model							.07
<i>N</i>							13.909

* $p < .05$; ** $p < .01$; *** $p < .001$.

Economics can be viewed on a small scale as a profession chosen more often by male students (4%). With poorer grades on a university entrance examination, the choice of this subject group increases by 3%. Regarding economic sciences, a clear antipathy can be seen if fathers pursued studies in the humanities (–5%), social sciences (–3%), medicine (–5%), or natural sciences (–4%). This also holds true if fathers have *not* earned a university degree, or if they completed professional training in the print/electronic media sectors (–7%). The familial inheritance of studies in this area is relatively low at 8%.

The study of medicine holds a special position in several respects. In addition to a slight preference from women (6%), here, as was assumed based on the results of the admissions procedures, grades play a special role. Per higher step on the grading scale, the probability of choosing to study medicine increases by 10%. However, if the father graduated from a university of applied science, it decreases by 13%. Nevertheless, the inheritance of the choice of the field of study is, at 26%, by far the strongest in comparison to other fields

of study. A medical degree is 3% more likely if the father has completed professional training in the commercial sector.

In addition to a male focus (10%) and the importance of better grades on the higher education entrance examination (4%), the choice of a scientific field of study goes together with a pronounced negative profile with respect to other fields of study, for example, if the father (−7%) pursued medical or social sciences studies (−6%), the choice of a field of study in this area of natural science is unlikely. The same applies to professional training in the commercial sector (−3%). However, if the father chose the same field of studies, a decision for a science degree is more probable (10%).

Engineering is most notably a male-dominated area of study (17%) which is characterized by some distance from various subjects studied by the father. Thus, a father's university degree in the humanities (−6%), legal studies (−6%), or medicine (−7%) make a decision for engineering less likely. However, as the only field of study group, here a non-university education of the father in the same area (technology: 5%) is important for this choice. The transmission of the field of study through the family tradition is 9%.

4. Discussion and implications

The results of the multivariate analysis for the determination of the choice of the field of studies at universities by social characteristics – whereby the ‘field of study inheritance’ as a new component has moved into focus – can be summarized as follows:

- In contrast to Bourdieu's findings from the 1960s (Bourdieu and Passeron 1971), vertical characteristics of social inequality, measured by the education or professional training of the father, do not play a substantial role in the selection of a field of study at the university level. Within this scope, of a total of 35 coefficients in the multinomial logistic model, only 2 (negative effect of technical school training on the choice of the social sciences; university of applied sciences training on the choice of medical studies) were significant. For hierarchical models, the semi-partial effect was only 0.3% according to McFadden's pseudo *R*-squared.
- Greater significance can, however, be attributed to the horizontal inequality factors regarding the transmission of the family occupational tradition. If there is a differentiation between university and non-university focal points, the inheritance of academic (university) disciplines clearly dominates. The reason is that for all fields of studies except medicine (26%), the probability of a decision in favour of the same group of academic subjects as the father is between 8% and 12%. However, this does not mean that non-academic (non-university) training focal points do not exert any influence on the selection of the field of study. These are, except for engineering (technology: 5%), most often not based on the same focal point and act in a negative direction (humanities: technology: −3%; economics: press/electronic media: −7%; natural sciences: commercial sector: −3%).
- Aside from the transmission of academic discipline traditions within families, there is, however, clearly a system of cultural distances, which means that the father's professional training focal point reduces the probability of choosing particular academic discipline groups. While this is probably not the case in the humanities, social sciences, or medicine, we find a well-developed system of distances from other fields of study in

studies of law (social sciences: -3% ; engineering: -4%), economics (social sciences: -3% ; medicine: -5%), natural sciences (social sciences: -7% ; medicine: -6%) and engineering (humanities: -6% ; legal studies: -6% ; medicine: -7%).

- There are distinct differences in grades on the higher education entrance examinations and in gender regarding the choice of a field of study. Social sciences (13%), the humanities (10%), and medicine (6%) can be regarded as female-dominated fields of study, while engineering (-17%), the natural sciences (-10%), and economics (-4%) tend to be male-dominated. In legal studies, the gender distribution is almost equal (2%). Due to the competitive admission process for medical school, good grades on university entrance examinations have the strongest effect on the choice of the field of study (-10%). This also holds true for the natural sciences (-4%). In contrast, a low grade indicates more that a student will decide for the humanities (5%), social sciences (3%), or economics (3%).

Because no relevant influence of vertical-origin-specific inequality (recorded based on the father's education and training) can be noted in the choice of a field of studies, we might suppose that this factor has weakened. If the time series for access to higher education and study choices is used, then this impression of change cannot be confirmed. Rather, the impression of certainty comes largely with the status of origin, because an inheritance of the field of studies connected with it, or is implied. If the factor of the field of study choice is not taken into account, then the general status of origin has a clear effect on a preference for medicine and law, and it has also recently increased for engineering at the university level, at a simultaneous decrease in the social sciences and humanities.

In this interpretation it should be noted, however, that the choice of an academic field at university represents the end of a chain of selection in which the children of educationally disadvantaged groups are 'over selected' (Heine 2012). Social selection according to the background social status determines the choice of the type of higher education (university versus university of applied science) far more than the decision for a field of study.

This is often overlooked because the 'field of study tradition' is not taken into account. Reimer and Pollack (2010) were able to confirm with data from the HIS-high school graduates panel that with the four options after high school graduation (no further education, vocational training, university, or university of applied sciences) in the period 1983–1999, there were significant class-specific differentials, which have continued virtually unchanged in the period since 2000. Within this scope, the strongest difference existed between the highest and lowest status groups in terms of university education or vocational training.

The authors further examined origin-specific horizontal inequality in field of study choices and thereby drew on the same field of study differentiation, which combined studies of medicine, law, the social sciences, and the humanities. As a result, a significant difference could be found between the highest and lowest status groups with respect to a decision in favour of study programmes in medicine and law for the highest and middle third of grades on the higher education entrance examination. This difference is entirely in accord with other studies and findings that only take the status of origin into account and not the field of study tradition.

In the discussion of the subject-cultural grouping of students according to the father's field of study, the findings are clear. The field of study tradition consistently exerts influence,

whereby it simultaneously includes reproduction according to social status, insofar as at the university level it is significantly more influential than the father's occupational background. A significant 'inheritance' exists, so that in each case a disproportionate share of students is found in the various fields of study, that is, students have already gained insight into the father's academic world and professional and cultural standards. We assume that this leads to greater self-confidence at university and in the academic discipline. Both are essential prerequisites for the successful completion of a student's course of study. Such contexts can also be important for the practice of university teaching, yet have so far received little attention. Given the identified relationship between the father's and the student's field of study choices, it would surely be worthwhile to investigate the consequences for university programme administration and academic success in more detail.

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No potential conflict of interest was reported by the authors.

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