Mechanisms for the effect of field of study on the transition from higher education to work: an empirical test of the training costs model

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Abstract

Several studies indicate a substantial impact of horizontal differentiations in higher education on monetary and non-pecuniary labour market outcomes. This paper scrutinizes the underlying mechanisms of this effect and addresses the question of why fields of study differ in early labour market returns. According to the training costs model the field of study indicates different amounts of training costs to employers. The average expected training costs of a study program are determined by the level of occupational specificity and the selective choice of the graduates. Specifically, 'soft fields' like humanities or social sciences are considered as less occupational specific and less academically challenging. Using the German HIS (Hochschul-Informations-System) Graduate Panel 1997 a test of the model shows that a lack of occupational specificity is partly responsible for difficulties in labour market entry of graduates from 'soft fields'. Whereas selectivity does not contribute to an explanation of differences between fields of study, structural characteristics such as the final degree type or the required expertise of a job are important mediating factors.

Key words: Field of Study, Higher Education, Transition from School to Work, Horizontal Differentiation

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Introduction

In recent years social scientists have been increasingly interested in the labour market rewards of different educational fields of study. Beyond the well-known impact of vertical educational level on social stratification it has been argued that within the processes of educational expansion in modern societies field of study becomes a more significant selection criterion for the allocation of individuals to jobs (Hansen, 2001; van de Werfhorst, 2002). As a result of an increasing number of tertiary graduates and a decreasing variance in educational credentials higher education provides a less reliable signal for employers (Jackson *et al.*, 2005; Kim and Kim, 2003). Thus, the educational level loses its potential as a filtering role and employers have to rely on other productivity signals such as the specific field of study. Moreover, it is assumed that in the course of educational expansion and a diversification of study programs the signalling value of 'soft fields' (Biglan, 1973), such as humanities or social sciences, becomes less indicative as they are less selective and more easily to complete successfully (Reimer *et al.*, 2008).

Most studies dealing with the impact of field of study on labour market outcomes are concerned with explaining the gender wage gap (Bobbitt-Zeher, 2007; Daymont and Andrisani, 1984; Gerhart, 1990; Kalmijn and Van der Lippe, 1997; Loury, 1997; Marini and Fan, 1997). Beside economic returns, there are studies available that focus on differences between fields of study in other labour market rewards such as occupational prestige (Katz-Gerro and Yaish, 2003; Shwed and Shavit, 2006), access to service class positions (Kim and Kim, 2003), employment status (Reimer and Steinmetz, 2009; Smyth, 2005), job mismatches (Robst, 2007; Wolbers, 2003), overeducation (Dolton and Vignoles, 2000; Ortiz and Kucel, 2008) or temporary employment (Giesecke and Schindler, 2008). Previous studies show that graduates who major in humanities or social sciences earn less than individuals in fields such as engineering and computer science (e.g. Bobbitt-Zeher, 2007; Daymont and Andrisani, 1984). With regard to non-pecuniary outcomes the literature mainly shows the same pattern: graduates from humanities and social sciences have more difficulties at labour market entry and are considerably less rewarded in terms of vertical and horizontal job match than their peers from other fields. Though, in the case of occupational status the disadvantages of degree holders in humanities are not that distinctive and vary between countries with different institutional arrangements (van de Werfhorst, 2004).

The aforementioned studies predominantly concentrate their research focus either on gender differences in returns to education or on cross-national comparisons of the impact of field of

study on labour market returns. Very few studies (van de Werfhorst, 2002; van de Werfhorst and Kraaykamp, 2001) are concerned with the underlying mechanisms accountable for the effect of field of study in general and systematically address the question why fields differ in their value on the labour market. Against this background, the paper intends to shed light on explaining factors, such as occupational specificity or selectivity, that account for the substantial impact of field of study on graduates' transition from higher education to work. Why do fields of study get different rewards on the labour market and why do particularly 'soft fields' come off worse at labour market entry than their peers in other fields?

Drawing on the HIS (Hochschul-Informations-System) Graduate Panel 1997 (Fabian and Minks, 2006) the study focuses on the German case and intends to explain differences between graduates from different fields of study in their labour market integration within this special setting. I argue that the German higher education system characterizes a high "transparency of competencies" (van de Werfhorst, 2004) as it is highly standardized, less stratified - no gradual study programs, such as bachelor's-master's structure - and has a vocationally oriented second-tier institution (Fachhochschule).[1] Within this setting the specific field provides employers with a clearer signal for potential productivity. Thus field of study differences in Germany should be strongly distinctive providing a good test case for tracing the mechanisms driving the effect.

The proposed explanation factors for the effect are mainly derived from the training costs model (Glebbeek *et al.*, 1989; van der Velden and Wolbers, 2007) and refer to differences between fields of study in occupational specificity and selectivity. Besides, I argue that the degree type and the institution (first-tier vs. second-tier) are important mediating variables since the specific study programs on offer are differently distributed across these structural attributes (Shwed and Shavit, 2006).

The three labour market outcomes of interest are duration of job search before starting the first significant job as well as the risk of overeducation and the risk of job mismatch in the first significant job after graduation. A relatively smooth transition into the labour market implying a short duration of job search after graduation is often seen as one important feature of early labour market success (cf. Teichler, 2000: 12). The other two dimensions are central aspects of a successful transition phase. This is due to the fact that employers do not have much information about the productivity level of applicants whereas job seekers may misinterpret job requirements and lack knowledge about job characteristics (cf. Wolbers,

[1] Since the data are from 1997 the characterization of the German higher education system refers to the pre-Bologna-Reform.

2003: 250). The vast literature on overeducation shows that having more education than is actually required in a job implies a lower wage than working in an occupation that fits the educational level (e.g. Daly *et al.*, 2000; Dolton and Vignoles, 2000; for an overview see Hartog, 2000). Overeducated workers also have a lower wage growth rate than adequately educated workers (Büchel and Mertens, 2004).[2] With regard to horizontal job mismatches in the US, Robst (2007) found out that being employed in a job that does not match the specific qualification of the studied field lowers the realized wages in comparison to a matched job. A penalty for job mismatch is also given in the case of non-monetary outcomes such as occupational status (Wolbers, 2003). Thus, these outcomes are highly relevant for graduates' integration into the labour market and the degree of susceptibility may substantially vary between fields of study.

In the next section, I elaborate on the theoretical considerations from which I derive hypotheses on underlying mechanisms and mediating factors being responsible for differences between fields of study in the aforementioned early labour market outcomes. Thereafter, I present the data and methods before showing the results of my study. The paper ends with a summary and a discussion.

Theoretical Background

According to human capital theory (Becker, 1993 [1964]) an employee's productivity level is directly determined by his or her individual skills. In order to increase their labour productivity people can invest in human capital such as general education or vocational training. As employers pay their workers according to their individual productivity people's wages raise the more qualified they are. Thus, wage differences are due to a direct wage competition driven by different investments in education.

Signalling and screening models (Spence, 1973) argue that employers are not able to directly assess the productivity level and hire job candidates on the basis of imperfect information about their true abilities. As the hiring of an employee is an investment under uncertainty, employers use educational credentials as 'signals' or 'screening devices' indicating general abilities, learning aptitude or motivational aspects.

The job-competition-theory (Thurow, 1975; 1979) argues that labour productivity is primarily determined by the characteristics of a job instead of the individual traits of a worker. In

[2] In a further paper Pollman-Schult and Büchel (2004) arrive at the conclusion that overeducation persists as a long-run phenomenon solely for rather unskilled workers. Instead, workers with high quality training, although being overeducated at career start have significantly better career prospects.

contrast to human capital theory people do not directly compete for wages but for jobs whose inherent productivity level determines the wages. Furthermore, the theory assumes that job-specific skills are predominantly acquired on-the-job and not in school. Thus, employers seek to employ the best available candidates for their vacancies, at the lowest training costs. Similar to the framework of 'signalling' educational credentials are used to indicate which candidates are most and least likely to be trained into given jobs. According to this approach job seekers are ranked into an imaginary labour queue and employers match this queue of applicants to a second queue of vacant jobs classified on the basis of their requirements. As education is an important predictor of an applicant's expected training costs, it determines the relative position in the labour queue. Thus, education is regarded as a positional good and the best occupational positions go to job seekers with the lowest training costs (with the highest educational certificates). According to matching theories (Sørensen and Kalleberg, 1981) potential employees considering their preferences search for jobs that promise large returns to their acquired educational degree. Thus, a suitable matching of employee and employer (occupation) is eligible for both actors.

A detailed consideration of educational credentials that determine the central concept of training costs remains rather unspecified in Thurow's framework. The training costs model (Glebbeek, et al., 1989) combines the aforementioned theoretical perspectives and applies it on horizontal differentiations in the educational system. In compliance with Thurow's model it assumes that employers cannot directly evaluate the expected training costs of an individual Instead, they have to deduce them from the average expected training costs of the chosen study program. However, consistent with the human capital approach the training costs model allows for the possibility that productive job-specific skills are actually acquired during schooling. According to the model the expected training costs of a certain study programme are determined by two components: occupational specificity and selectivity.[3]

Occupational specificity refers to the degree of employability and practicability of study contents in certain occupations on the labour market. The more specific the preparation or the more narrow the occupational profile of a study programme, the less additional training employers have to invest in graduates' job-specific skills. Thus, a high occupational specificity should improve the match between employer and employee. Instead, students graduating in a more general study programme lack in occupational skills and thus require

[3] Actually, the authors refer to three components the educational level being one central component. As the research focus lies on the tertiary graduate labour market and the impact of academic fields, the vertical level is held constant.

more on-the-job-training and signal higher uncertainty. As they have more often to compete against job seekers with specific skills, they have more difficulties in finding a (matching) job. From the perspective of the graduate one could also argue that the costs of accepting an occupation that does not match the field of study is lower for job seekers that graduated in a field providing more general skills, as occupational mobility is more likely (Robst, 2007).

> ***Hypothesis 1:*** *The more specific the study programme (field of study), the smoother graduates' transition from higher education to work.*

Selectivity refers to the fact that study programmes differ in the average quality of students with regard to pre-study competencies. It is argued that education does not produce a homogenous good and educational credentials in that case fields of study hide a substantial variation in quality. Selectivity not only refers to between-field differences in quality aspects but also to within-field variation in ability. The wider the range of graduates' quality within a field, the more risky it is for employers to hire an employee that lacks the skills necessary for the vacant occupation. Thus, highly selective study programmes offer less uncertainty about the abilities of their graduates than study programmes that lack a selective composition of their student body. Selectivity may be enhanced by closure strategies (Weeden, 2002) such as student-in-take restrictions in form of institutionalized selection procedures.[4] As this closure strategy raises the average ability level of graduates from more competitive fields, these study programmes indicate a lower risk of choosing an inadequate applicant.

> ***Hypothesis 2:*** *The more selective the study programme (field of study), the smoother graduates' transition from higher education to work.*

Furthermore, I argue that the type of degree (Magister vs. Diplom vs. Staatsexamen) and the tertiary institution (first-tier universities vs. second-tier 'Fachhochschulen') are substantial mediating components for the impact of field of study on labour market outcomes. This is due to the fact that the different degrees and institutions substantially differ in the provision of fields of study (see Table A1). Not every field of study is offered within every degree-program or institution. Thus, these institutional characteristics that serve as signals to

[4] In the German case, the numerus clausus regulates access to some fields of study that are related to privileged professions. The assortment is based on the 'Abitur' grade and waiting terms. Thus, only a certain fraction (probably the most cognitively able and financially endowed) is allowed to study these programs.

employers as well may be to some extent responsible for differences in fields of study. As graduates with 'Staatsexamen'-degree have a highly institutionalized transition into the labour market, their occupational possibilities are more or less prescribed. Thus, these graduates should have fewer difficulties at labour market entry with regard to job search and the job quality of the first significant job in comparison to their peers with other degree types. In contrast, the 'Magister'-degree lacks an occupational specified profile, as it is often composed of various fields of study that are sometimes related, but sometimes even cross the broadest categories of fields study. It may also be devaluated by employers and regarded as a negative selection criterion because of a non-selective student population. Thus, 'Magister'-graduates should perform worse than graduates with 'Diplom'-degree at career start. For graduates from 'Fachhochschulen' the expectations are not that clear-cut. On the one hand these second-tier institutions have more occupation-specific programmes and thus offer employers a more distinct signal of graduates' potential skills than universities. On the other hand, the 'Fachhochschule' still misses the prestigious reputation of universities, although their labour market returns have converged towards the ones from universities (Müller *et al.*, 2002).

> ***Hypothesis 3:*** Differences between fields of study in the transition from higher education to work are mediated by the type of degree (Magister vs. Diplom vs. Staatsexamen) and the tertiary institution (first-tier universities vs. second-tier Fachhochschulen).

Besides, positional characteristics of the job may operate as mediating factors for field-specific labour market returns. There may be structural relations between fields of study and job characteristics that affect the risk of being overeducated or having a job mismatch. Thus, field-specific differences occur not due to individual characteristics of graduates but are the result of a direct structure-induced link between fields of study and labour market positions. For example Wolbers (2003) finds out that school-leavers who have a temporary or part-time contract, work in smaller firms or in the private sector have a higher risk of job mismatch. If the field of study is systematically related to these job characteristics, these have a high potential of mediating the impact of field of study on the considered labour market outcomes.

> ***Hypothesis 4:*** *Differences between fields of study in the risk of overeducation and job mismatch are mediated by job characteristics.*

Moreover, the training costs model argues that a strong link between education and job is not relevant for all jobs and labour markets to the same extent (cf.Glebbeek, et al., 1989: 60). Occupations differ in their necessary requirements for skills that are learned in the educational system and thus the importance of occupational specificity also depends on the characteristics of a job (de Wolf and van der Velden, 2001).[5] The more task-specific the job (the more expertise is required), the higher the potential training costs for guaranteeing an adequate performance on the job. The higher the training costs, the more important the choice of an applicant with job-specific knowledge in order to keep the training costs as low as possible. If some fields of study have a narrow occupational profile, while others lack occupation-specific training, the former ones are predominantly chosen for those occupations that require specific expertise. Hence, differences between fields of study in the risk of overeducation and job mismatch may be mediated by the task specificity of occupations.

> ***Hypothesis 5:*** *The more task-specific the requirements of a job, the more important the match between employer and employee. Thus, field of study differences in the risk of job mismatch and overeducation may be mediated by their different access paths into occupations that require a different degree of task specificity.*

Data and Measures

In order to test my hypotheses I use the HIS (Hochschul-Informations-System) Graduate Panel 1997 (Fabian and Minks, 2006). It is a representative nationwide study of tertiary graduates in Germany who graduated in the year 1997. Overall 6216 respondents were asked in mail survey about their studies, the graduation process and their subsequent labour market integration one and five years after graduation. In addition, they reported their full employment history for the first five years after graduation. As respondents were not directly asked how long they searched for the first job, the event-history design was used to extract the job search duration until first significant job out of the employment history. [6]

The sample was further restricted due to theoretical reasoning. Graduates who became self-employed in their first significant job or started a second non-constitutive course of studies

[5] For example in the growing occupations of personal services individual characteristics such as self-representation, appearance or accent are more important than specific knowledge or expertise (Jackson, et al., 2005).

[6] Unfortunately, I only have information on job characteristics for the first (not implicitly the first significant one) and current job in the first wave and the current job in the second wave. If the first significant job (derived from the employment history) is not the first one asked about and does not fall in the period of the first or the second wave, I do not have information on this job. Therefore, for the analyses on overeducation and job mismatch in the first significant job not all cases could be included.

are excluded from the analyses.[7] Furthermore, graduates are not part of the sample if they did not finish their second schooling phase (traineeship, junior doctor), the promotion or postgraduate studies in the first five years.

The three labour market outcomes of interest are the job search duration, the risk of overeducation and the risk of job mismatch.

Job search duration is measured as the period between the month of final degree or the end of the second schooling phase and the beginning month of the first reported significant employment spell in the employment history. A job is defined as the first significant one if a graduate's early work biography indicates "dependent employment" for the first time.[8] Whereas the episodes in the status "unemployed", "freelance work", "to job", "internship", "advanced training" or "family work" are counted as search time, "miscellaneous" or "parental leave" are not considered as active search time and therefore not counted as such.

Overeducation can be measured with objective or subjective measures. One of the objective approaches is to rely on professional labour analysts who establish indicators that classify occupations and their correspondence with the adequate educational level. One example is the General Educational Development (GED) in the Dictionary of Occupational Titles (Rumberger, 1987). Another objective measurement assigns occupations an adequate educational level based on the average amount of schooling workers in a certain occupation have (Verdugo and Verdugo, 1989). Thus, an employee is overeducated in his current job if the years of schooling exceed the average number of years taking into account the standard deviation. However, the objective measurement was criticised by several authors (e.g. Halaby, 1994). On the one hand, it neglects the fact that graduates differ in magnitude and type of skills. Second, these measures do not consider intra-occupational heterogeneity: the same occupational category encompasses different tasks that may require different educational levels.

The second possibility of measurement relies on the report of the graduate and his or her evaluation of the educational requirements for the current job. Although responses may be biased due to social desirability or dissatisfaction with the job that does not automatically

[7] As the demand side of employers and their selection behavior play a central role in my theoretical argumentation, the hypotheses are not transferable to graduates who become self-employed. When graduates study a second field, employers will use the recent study as a signal. Thus, the use of the first study program does not make any sense for the evaluation of fields of study. The dataset also lacks additional information on the second studies.

[8] These employment spells are distinguishable from short-term stop-gap jobs and marginal employments (all kinds of minor work such as summer jobs and other casual employment or internships).

arise from underutilization of skills, the subjective approach is expected to provide more detailed information and is regarded as more powerful (Büchel, 1998; Halaby, 1994).

In the HIS Graduate Panel 1997 graduates were directly asked if they are employed adequately with regard to their acquired academic degree. A graduate is overeducated (coded one) in his or her first significant job if he or she indicates that for this position tertiary education is either irrelevant or not the standard, whereas he or she is adequately educated when answering that a tertiary degree is compulsory or the standard (coded zero).[9]

Job mismatch is also based on a subjective measurement for the same reasons as indicated above. An objective assessment of a job mismatch seems to be quite arbitrary, as fields may apply to several different occupations and one has to decide whether the field of study and a job are unrelated. The dichotomous variable indicates a mismatch in the first significant job if graduates answer in the negative to the question or are not sure whether their position is adequate according to their field of study (coded one). In contrast, respondents have a matched position if they are definitely or pretty sure that their job fits to their studies.

Based on the ISCED-97 classification (UNESCO, 1997) the *field of study* as central independent variable is coded into ten categories: education, arts, humanities, social/behavioural sciences, business/economics, law, science/mathematics, engineering, agriculture and health/welfare.

Several measures are used as indicators of *occupational specificity*. *First*, I constructed a dispersion index as previously used by other researchers (de Vries and Wolbers, 2005; Dekker *et al.*, 2002; Giesecke and Schindler, 2008). The index is a measure of concentration indicating the distribution of ISCO-88 (COM) occupations (3-digit codes) within a certain field of study group (field-based dispersion). The range is between 0 and 1, where higher values represent a homogeneous distribution across occupations and thus a high occupational specificity, lower values indicate the opposite.[10] In addition, I generated an index that measures for each occupation the degree of homogeneity with regard to the distribution of employees' field of study (occupation-based dispersion index). The *second* measure refers to a subjective assessment of the content of the study programme. Graduates were asked about the up-to-dateness of practical requirements and the exercising of job-related professional

[9] The assignment of the between-categories to the dichotomous variable additionally depends on the occupational status as well as the subjective adequacy with regard to prestige or cognitive level of work tasks (see Figure A1).

[10] In the original formula (see Figure A2) higher values indicate a more heterogeneous distribution. For illustrative reasons and interpretation in terms of occupational specificity the pattern is reversed.

action[11]. I argue that these two items represent a further dimension of specificity that prepares students for a narrower job profile. Thus, an index was constructed and standardized between 0 and 1, where high values indicate a high occupational specificity. The *third* measurement represents the homogeneity or diversity of fields that a graduate combined during studies. Studying only one major indicates a low diversity and thus a high occupational specificity, whereas the combination of a major and minor not belonging to the same field of study group is evaluated as high diversity and low specificity. Joining a major and minor being at least in the same field group is seen as somewhere in between.

The *selectivity* of a field of study is operationalised with two measures: the average 'Abitur'[12] grades within a field and the standard deviation of 'Abitur' grades within a field. The two different measures are to represent both the level of skills as well as the dispersion of skills around the mean.

With regard to *type of degree* and *tertiary institution* I constructed a categorical independent variable differentiating between 'FH' (Fachhochschule = university of applied sciences), 'Staatsexamen', 'Diplom' and 'Magister'. Unlike at universities there is no differentiation between degree types at the second-tier institutions where 'Diplom (FH)' is the only attainable degree. Thus, a combined consideration in one variable is a sensible approach.

In order to determine the impact of *job characteristics* as potential mediating variables, I used five variables. These refer to *temporary* vs. permanent or *part-time* vs. full-time jobs. Further, I established a binary dummy variable that distinguishes between occupations in *large firms* (above 1000 employees; coded 1) and small firms (below 1000 employees; coded zero). Last, the *economic sector* or branch was operationalised by adding a categorical dummy variable differentiating between industry, private service and public sector.

Hypothesis 5 aims to test whether a different degree of *task specificity* or requirement for expertise in jobs and the different access paths into these occupations are partially responsible for differences between fields of study in graduates' quality of the job. Therefore, I use a question that asks graduates about the importance of specific expertise in their current job. The respondents were able to choose between the answering categories 'very important', 'useful' and 'unimportant'. Again, the variable was constructed between 0 and 1, where high values indicate high task specificity and vice versa. In a next step, I have built for every

[11] The answer options for both items range from 'very good' to 'very bad' on a pentatonic scale.

[12] The 'Abitur' is the necessary requirement for the entitlement to higher education in Germany. For some fields of study that have a 'numerus clausus' 'Abitur' grades are important prerequisites for admission.

ISCO-88 (COM) occupation (3-digit codes) the average importance of expertise of employees working in a certain occupation. Thus, this measure, such as the occupation-based dispersion index does not refer to the individual level but to the occupation-level.

Beside the potential mediating variables I include further control variables that account for individual differences between graduates in all models. As measures of study performance I control for the *final grade* and the *duration of study*. Moreover, I consider whether a graduate completed *vocational training* or accumulated *experience in the labour market* before starting the studies. Besides, additional qualifications such as *field-specific part-time work* or *mandatory internships* during studies are included in the analyses. I also control for parents' education, gender, age at graduation and having a child at graduation

Statistical Modelling

For the descriptive analyses of the speed of entry into the first significant job[13] I estimate survival functions using the Kaplan-Meier method (product-limit estimator) for each field of study group separately. The Kaplan-Meier estimation is based on the calculation of conditional probabilities of survival beyond each time point when an event occurs given the survival up until this time point. Then the product limit of these probabilities is taken to estimate the survivor function S(t) indicating the probability of survival past time t. The product limit estimate of S(t) at any time is given by:

$$\hat{S}(t) = \prod_{j|t_j \le t} \left(\frac{n_j - d_j}{n_j} \right)$$

In the multivariate analyses I use continuous-time hazard models (Cleves, et al., 2004; Singer and Willett, 2003) to investigate in several models the impact of field of study on the duration of job search under control of my hypothesized mechanisms. Specifically, the Cox regression bears the advantage that it makes no assumptions about the shape of the hazard[14] over time. There is no need to assign the baseline hazard $h(t_0)$ a specific parameterization.[15] The Cox

[13] The variable search time includes 106 (1.66 %) right-censored cases that did not find a job until the last interview time at second wave. However, the main problem of OLS-regression in the analysis of survival data is not the censored data, but the assumed normality of the residuals (Cleves *et al.*, 2004)

[14] The hazard rate refers to the probability that the failure event (in this case finding a significant job) occurs in a given interval, conditional upon survival to the beginning of that interval, divided by the width of the interval:

$$h(t) = \lim_{\Delta t \to 0} \frac{\Pr(t + \Delta t > T > t \mid T > t}{\Delta t}$$

[15] The baseline hazard can take any form that is adequate for the description of event occurrence in the data. The model only postulates that it has some shape and is a continuous function.

regression is called semi-parametric because it solely specifies a functional form for the impact of covariates on the unspecified baseline hazard.

$$\log h(t_{ij}) = \log h_0(t_j) + [\beta_1 X_{1ij} + \beta_2 X_{2ij} + ... + \beta_p X_{pij}$$

The requirement of this model is that the individual-specific hazards are multiplicative replicas of each other. Therefore, the hazard ratios corresponding to unit differences in the value of the associated predictor are constant over time, meaning that the effects of covariates can only cause proportional shifts in the hazard rate:

$$\frac{h_0(t_j)e^{(\beta(c+1))}}{h_0(t_j)e^{\beta c}} = \frac{h_0(t_j)e^{\beta c}e^{\beta}}{h_0(t_j)e^{\beta c}} = e^{\beta}$$

As a central assumption of the Cox regression the proportional hazards has to be tested. Regression diagnostics such as a graphical examination or a test based on Schoenfeld residuals (cf. Cleves, et al., 2004: 200) reveal that with regard to my main variable of interest, field of study, the requirement of proportional hazards does not hold. A non-proportional hazard model via stratification after field of study that assumes multiple baseline hazard functions is no solution to my problem, as it does not model and describe the effect of my central variable field of study anymore (cf. Singer and Willett, 2003: 562).[16] A further strategy to cope with the central assumption is to fit a model that includes interactions with time as a predictor (Cleves, et al., 2004; Singer and Willett, 2003). This interaction can be continuous (the effect of field of study on the hazard varies linearly with time) or piecewise-constant (the effect differs piecewise with time). I opt for a continuous time-varying variable for reasons of parsimonious representation and convenience of model comparison.[17] A non-proportional Cox model "automatically corrects the violation of the proportionality assumption." (Blossfeld *et al.*, 2007: 237).

The risk of overeducation and job mismatch is both estimated by means of common logistic regression models.

Characteristics of the sample

Figure 1 presents the Kaplan-Meier survival functions for each field of study separately. As can be easily seen graduates from humanities, arts and social sciences have a rather

[16] However, a stratified solution is relevant, if the proportional hazard assumption is not valid for control variables. Therefore, all further event history models are stratified after field-specific part-time work, mandatory internship, age at graduation and child at graduation.

[17] Specifically, my model specification postulates that the effect of field of study varies linearly with the logarithm of time. To facilitate interpretation I use logs to the base of 2 meaning that the interaction term represents the change in log hazard differences between fields of study as the length of job search doubles. This specification has the lowest AIC statistic of several models that differently specify the interaction with time.

problematic transition into the labour market and more difficulties in finding a first significant job than their peers from other fields. Although better than half of the graduates in humanities are employed in a significant job after three months, the job search proves to be more difficult with increasing search time. For instance, more than a fourth of the job seekers still are on job search after one year since graduation. Graduates from arts and social sciences already face challenges in finding a significant job shortly after graduation. Solely 30% of the social science graduates are in regular employment after one month; for graduates from arts the proportion is even under 20%. The estimated median life time to find a significant job adds up to four months for social scientists and five months for arts graduates. On the contrary, the median life time for graduates from health/welfare, science and education solely is one month. Apparently, these fields of study have a rather smooth integration into the labour market.

[Figure 1]

With regard to job quality graduates from humanities are the group that is mostly affected by overeducation in their first significant job. As indicated in figure 2, curtly 35% of graduates from humanities work in occupations that do not require a higher education degree. Furthermore, graduates from the fields business and economics as well as agriculture have difficulties in finding an adequate occupation according to their acquired degree. Social scientists and artists queue themselves in the midfield, but still have a rather high risk of being employed in a job where they underutilize their skills. Against it, graduates from health and welfare, law and science are quite successful in finding a job that is suitable for a higher education degree.

[Figure 2]

Figure 3 shows the field-specific risks of having a job mismatch in the first significant job. Again, graduates from humanities by far have the highest share of employees that work in an occupation that does not fit to the field of study: 56% of them are mismatched in their first significant job. Social scientists have strong difficulties in finding an adequate occupation according to their acquired degree as well. Almost half of the social scientists are exposed to an occupation where they cannot use their field-related skills. Astonishingly, graduates from arts are quite able to find regular jobs that match their field of study. However, compared to the risk of overeducation the problem of job mismatch seems to be much more severe for

graduates from 'soft fields'. Overall, graduates from health and welfare as well as law have the lowest risk of having a job mismatch.

[Figure 3]

Summing up, the descriptive results predominantly indicate that above all graduates from humanities, social sciences and arts are exposed to a difficult transition phase at labour market entry. In the next section on multivariate results I try to explore why this is the case and test the underlying mechanisms proposed in the theoretical part.

Multivariate Results

Speed of Entry into first significant job

Table 1 shows non-proportional Cox regression models of the transition into a first significant job where the effect of the central predictor field of study varies linearly with the logarithm of time.[18] Under consideration of individual characteristics the main effects in model 1 indicate for every field of study the differences in log hazards in comparison to the reference category health and welfare for the first month (the beginning of the time). As the log of one is zero, the yielded estimated hazard ratio for humanities towards health/welfare is $e^{-0.65} = 0.52$. That implies that graduates from humanities have one by the factor 0.52 significantly lower job finding rate in the first month than their peers from health and welfare. Overall, every field of study has a significantly lower rate of job entry at the beginning of the job search in comparison to health and welfare. The problem of finding a job direct after graduation is most severe for graduates from arts and social sciences followed by humanities. The significant interaction parameter proof again that the assumption of proportional hazards is not given. For instance, the estimated difference of 0.45 in log hazard between law and the reference at the beginning becomes smaller by 0.33, as the job search duration doubles. With regard to humanities again, at month 2 the estimated hazard ratio in reference to health and welfare is $e^{(-0.65 + \log_2(2)\times(0.10))} = 0.58$, whereas at the 8th month of job search the hazard ratio only is $^{(-0.65 + \log_2(8)\times(0.10))} = 0.70$. In general, the longer the job search the lower the differences in the job finding rate between the other fields of study and health/welfare. For graduates from soft

[18] In order to check the robustness of my results I used different hazard rate models. A piecewise-constant model specification does not fundamentally alter the main results. A parameterization with a Gompertz-function specifying a monotonously decreasing hazard rate leads to similar results as well.

fields this reduction in log hazard differences over time seems to be the lowest in comparison to the other fields.

In order to test the first hypothesis model 2 includes the *specificity* measures. At least the first indicator, the dispersion index, shows that occupational specificity leads to a significant reduction in the duration of job search. The more homogenous the occupations with respect to employees' fields of study the higher the job finding rate for these occupations. Thus, a stronger link between field of study and occupation, indicating a high specificity, is beneficial for the shortening of search time. In contrast, the specificity with respect to the communicated content during studies has no significant impact on the hazard rate.[19] In comparison to graduates with only one subject graduates with several ones that belong to the same field group have a significantly lower job finding rate by the factor $e^{(-0.30)}$ 0.74. However, the impact of high field diversity (several subjects in different areas) although negative is not significant at conventional criteria. Under control of these measures the main effects for the first transition month are particularly reduced for the soft fields. Though, the log hazard differences towards health and welfare remain highly significant. Furthermore, from model 1 to model 2 there are no substantial changes in the interaction terms.

[Table 1]

As can be seen in model 3 the worse the average Abitur grades within a field of study the lower the job finding rate for graduates from this field. Thus, graduates from highly *selective* fields have advantages in the job search process. The quality range of graduates, measured with the standard deviation of 'Abitur' grades, has no significant impact on the transition into the first significant job. Overall, the log hazard differences towards health and welfare do not fundamentally change after consideration of selectivity measures. Again, the interaction terms remain highly stable.

Model 4 reveals substantial differences in the search duration for the first significant job between different types of final degree. In comparison to graduates with 'Staatsexamen' graduates with 'Magister' have a lower job finding rate by the factor of $e^{(-0.66)} = 0.52$ under control of all other covariates. The hazard ratio between 'FH' and Staatsexamen is $e^{(-0.49)} = 0.61$; the one between 'Diplom' and 'Staatsexamen' $e^{(-0.34)} = 0.71$. As expected graduates with a 'Staatexamen'-degree have the least problems in finding a job after graduation, whereas

[19] Controlling for type of final degree the impact becomes significant: The higher the content specificity the higher the hazard rate of finding a job.

graduates with 'Magister' are most frequently disadvantaged at labour market entry with respect to a successful job search. Under consideration of the type of final degree the log hazard differences for graduates from humanities and science become insignificant for the first month. In return, for these fields the difference in hazard does not significantly vary with time anymore.

Except for two fields the differences towards health and welfare at the beginning of time remain highly significant even though controlling for the proposed mechanisms. The interactions with time remain highly stable as well, indicating that the severe differences are mitigated the longer the job search takes. Nevertheless, a large part of differences between fields of study with regard to job search are not explained in my analyses.

Risk of overeducation in first significant job

Table 2 presents logistic regression models for the binary variable overeducation in the first significant job. Model 1 indicates the log odds of being overeducated for the different fields of study in reference to the category health/welfare controlling for individual characteristics. Graduates from every field of study except law have a significantly higher probability of being overeducated than their peers from health and welfare. As already seen in the descriptive results, graduates from humanities are most susceptible to overeducation in the first significant job, followed by arts, agriculture and business/economics. In comparison to a model without control of individual characteristics the log odds differences towards health and welfare are even slightly more pronounced.[20]

Model 2 includes the three constructed *specificity*-measures[21] in order to test hypothesis 1. The occupation-based dispersion index has a significant negative effect meaning that the more homogenous (specific) the occupation according to employees' field of study the lower the risk of being overeducated. The second measure is significantly negative at the 5%-criteria as well: the more specific the field of study with regard to content the less likely graduates face overeducation in their first significant job. In contrast, the third measure of field diversity exerts no significant impact on overeducation. The field of study differences towards the highly specific health and welfare are predominantly reduced. However, the coefficients for humanities and business/economics still remain highly significant. The difference between the social scientists as well as arts and the reference category decreases towards the 0.1%

[20] This is mainly due to the fact that graduates from health and welfare have worse final grades than their peers from other fields of study (except law).

[21] Due to problems with multicollinearity I cannot estimate the effects of fields of study and the field-based dispersion index in the same model. Therefore, I control the occupation-based dispersion index as a proxy of homogeneity.

significance level, whereas the coefficient of science loses its significance. Overall, differences between fields of study in the risk of overeducation still remain on a high level even though controlling for occupational specificity. Nevertheless, it can be argued that occupational specificity partly explains these differences.

Regarding the *selectivity*-measures model 3 reveals the following relation: the worse the average 'Abitur' grades within a field of study the higher the risk of overeducation for graduates of this field. However, the dispersion of skills within a field of study has no significant effect on overeducation. The measures are rather limited to explain differences as they are no substantial changes in the coefficients of the 'soft fields' arts, humanities or social sciences. Interestingly, the log odds difference between education and the reference category 'health and welfare' is not significant anymore. This is due to the fact that graduates from education have by far the worst 'Abitur' grades, whereas access to health and welfare is highly selective.

Overall, there are rather mixed results for the evaluation of hypothesis 2.

[Table 2]

In order to test hypothesis 3 model 4 includes the *type of final degree.* This variable has strong effects on the individual risk ob being employed in an education that does not require a higher education degree. For instance, graduates from Fachhochschulen have a 17.5 times ($e^{2.86}$) higher risk of being overeducated than graduates from Staatsexamen. The log odds differences between Diplom as well as Magister and the reference category are highly significant, too. This is not surprising as there is a highly structured link between Staatsexamen and specific occupations that necessarily presuppose a higher education degree. Unexpectedly, Diplom- and Magister-degrees do not differ to a high extent in their risk of overeducation. The relatively high susceptibility to overeducation for graduates from Fachhochschulen indicates that despite the occupational specific training this institution may still lack the prestige of universities and thus may be devalued by employers. The type of institution seems to be a strong mediating factor for the impact of field of study[22], as for instance the difference between humanities and health /welfare is reduced to the 0.1% significance level. The significant effect for arts even completely disappears, whereas the difference for business/economics towards the reference is reduced to the 1%-level.

[22] The reduced differences in the log odds of being overeducated would have been even more pronounced, if I had only considered medicine (with Staatsexamen degree) as reference category.

Model 5 additionally incorporates *job characteristics* that may mediate field of study effects on the risk of overeducation. Graduates that work part-time have a higher risk of underutilizing their skills in their first significant job. Temporary employment and firm size do not play a significant role in the risk of overeducation. Working in the public sector instead in the industry sector significantly reduces the risk of being overeducated by a factor of 0.34 ($e^{-1.06}$). Although a high requirement of expertise or task specificity reduces the risk of overeducation, the impact is not significant at conventional criteria. Controlling job characteristics in particular the sector reduces the differences between the soft fields of humanities as well as social sciences and health/welfare to such an extent that they become insignificant. The high susceptibility to overeducation for graduates from business and economics is totally explained in model 5 as well. In model 5 graduates from engineering even have a lower risk of overeducation than their peers from health and welfare. Thus, structural conditions are an important mechanism for the effect of field of study on overeducation.

Risk of job mismatch in first significant job

The results of logistic regression models of having a job mismatch in the first significant job are presented in table 3. The model specifications are identical to the analysis on overeducation. Under control of the individual characteristics graduates from humanities and social sciences still have the highest risk of being mismatched in their first significant occupation. Against it, the difference in log odds for graduates from arts towards health and welfare is not significant. As in the case of overeducation graduates from health and welfare have the lowest risk of being employed in a job that does not fit to their study program.

Model 2 includes the measures of *occupational specificity* and shows that both a low dispersion of fields of study within occupations as well as a high specificity according to field of study content significantly lower the risk of a job mismatch at the 5%-level. Moreover, a medium diversity of fields of study significantly increases the risk of being mismatched, whereas graduates with a high diversity surprisingly are not more often prone to job mismatch than graduates with only one field of study. Controlling for occupational specificity reduces the differences in log odds towards health and welfare for every field of study, especially for humanities.

In model 3 it can be seen that both *selectivity measures* have no significant impact on the risk of having a job mismatch. Accordingly, the coefficients of the different fields only change

marginally. Thus, the selectivity of a study program seems to be no substantial underlying mechanism that mediates differences between fields in job matching procedures.

[Table 3]

Model 4 includes the *final type of degree* and indicates that among all graduates the ones with Staatsexamen have the lowest risk of being mismatched in their first significant job. In contrast to the analysis of overeducation graduates with a Magister-degree have the highest risk of working in an occupation that is not adequate for the field of study. Whereas FH-graduates also have a significantly higher risk of job mismatch than their peers graduating with Staatsexamen, for graduates with a Diplom-degree the log odds difference in reference to Staatsexamen is comparatively small, but still significant at the 5%-level. Due to the high share of graduates with Magister in the field of humanities and the negative impact of this degree the difference between humanities and health/welfare becomes insignificant when controlling the type of degree. Whereas the effects of social sciences as well as business and economics are largely reduced, but remain significant at conventional criteria, the difference between science and the reference fully loses its significance. Again, the type of institution or final degree as mediator seems to be partially responsible for differences between fields in graduates' labour market integration.

In Model 5 I consider job characteristics in order to test the hypotheses 4 and 5. However, neither part-time employment, temporary employment nor the firm size have a significant impact on the risk of having a job mismatch. As in the case of overeducation employment in the public sector seems to be crucial in order to prevent a job mismatch. In comparison to employees in the industry sector the ones in the public sector have a lower risk of being mismatched in their first significant job by the factor of 0.52 ($e^{-0.65}$). Furthermore, the task specificity or required expertise in a job has a highly significant impact on the risk of job mismatch. The more expertise or specific know-how an occupation demands the lower the probability that in this occupation job applicants are mismatched according to their field of study. Thus, in occupations which require a high level of occupation-specific skills the choice of an adequate job applicant with low training costs is more important than in other occupations. As argued in the theoretical discussion job characteristics, particularly the task specificity, act as mediators for the impact of field of study on job mismatch. Thus, in model 5 all significant log odds differences towards the reference health and welfare (except for education) vanish under control of job characteristics. Overall, the field of study differences

are mainly explained by the proposed mechanisms. In particular, the high susceptibility to job mismatch for graduates from soft fields is reduced to a marginal under control of the underlying mechanisms.

Summary and Discussion

In this article, I tried to investigate the underlying mechanisms for the effect of field of study on the transition from higher education to work. Based on the training costs model it was hypothesized that the more occupational-specific or selective a field of study is the smoother the labour market integration of tertiary graduates with respect to job search duration, risk of overeducation and job mismatch. Furthermore, I argued that due to a different provision of fields of study beyond type of degrees these attributes as independent signal for employers are mediating factors for differences in fields of study at labour market entry. Additionally, structural linkages between fields of study and specific job characteristics may partially account for the impact of fields of study on the observed outcomes. In particular, I proposed that the more expertise the occupation requires, the more important the choice of an applicant with job-specific knowledge and thus the more relevant fields that offer a narrow occupational profile.

The characteristics of the sample reveal that graduates from 'soft fields' such as humanities, social sciences and arts are predominantly disadvantaged at labour market entry. In comparison to 'hard fields' they take longer to find their first significant job, are more often overeducated and have a higher risk of being mismatched in this first occupation.

With regard to the first central indicator for the average training costs of a field of study, occupational specificity, multivariate analyses show that at least two measurements have a positive impact on the three outcomes. Specificity reduces the job search duration and lowers the risk of being overeducated or mismatched in the first significant job.

The second component of the training costs model, the selectivity, seems to be a rather subordinate signal for employers. There are no continuous positive effects of the used measurements on a smooth transition into the labour market. This may be due to the fact that the operationalization solely documents the quality of students approximately.[23] Nevertheless, using my proxy measures, the proposed mechanisms of the training costs model can only partially rejected: at least occupational specificity seem to be decisive at labour market entry.

[23] The operationalization would have been more adequate, if I had used (unobserved) measures of performance or competencies that do not rely on grades in school. Employers can evaluate the individual 'Abitur' grade as well as the final grade of studies and do not have to derive the quality of the student from the average field quality. However, if there are skill differences between fields of study that are not indicated by grades, this might have a substantial influence on employers' perceptions.

The type of final degree has a large influence on a successful transition from higher education to work. Graduates from Staatsexamen have the best employment outlook at labour market entry, whereas graduates from Magister face the longest job search duration and a high risk of being overeducated and mismatched. The problems of Magister-graduates are most severe in the case of job search and finding a matching job. Against, FH-graduates have the highest risk of overeducation among all types of degrees. Thus, in the case of an oversupply of graduates from higher education the ones with FH-degree are most susceptible to downward competition. Overall, the effects show that beyond field of study the type of degree is a relevant signal for employers indicating different degrees of specificity or quality as well.

Further analyses for overeducation and job mismatch reveal that graduates who work in the public sector have a significantly lower risk of being not adequately employed. Except for a significant impact of part-time work on overeducation other job characteristics do not influence the two outcomes. As derived from the training costs model the task specificity of a job lowers the risk of being mismatched in this job. The more specific the required expertise to do a job, the more probable a 'good match' between job content and the acquired skills learned in the study program.

The statistical control of these different 'mechanisms' leads to the fact that differences between 'soft fields' and the reference category health and welfare in early labour market outcomes become largely insignificant. Though, in the speed of labour market entry there are still significant differences between social sciences as well as arts and health and welfare under control of the hypothesized mediators.

Overall, the results for Germany show that occupational specificity combined with varying structural linkages into the labour market are mainly responsible for differences between fields of study in labour market integration. The question is whether this is an institutional peculiarity of Germany, as occupation-specific skills during schooling and a highly structured transition into the labour market are predominant features of the secondary education in Germany. Are these results comparable to other countries and their educational system and labour market or do different mechanisms for the effect of field of study work in differently institutionalized environments?

The focus of the paper was on supply-side explanations of the effect of field of study. Certainly, demand-side factors may play a crucial role as well. It was automatically assumed that every field of study competes with the other ones about vacancies. However, fields of study are linked to different labour markets with varying demands, as indicated by the mediating effect of public sector on overeducation and job mismatch. The disregard of

demand-side factors could possibly explain the remaining differences between fields of study in job search duration.

As the Bologna-reform and its adjustment towards the Bachelor's-Master's structure intends to provide graduates with more occupation-specific skills within the Bachelor-program in particular for 'soft fields' such humanities, further research should have a look on the temporal development of differences between fields of study and possibly changing mechanisms after the reform.

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Appendix

Figure A1: Design of binary variable overeducation

Level of educational requirement for the exercise of the job	Positional adequacy[1]	Adequacy according to the level of job design[2]				
		5 in no case	4	3	2	1 definitely
Tertiary education is irrelevant	5 in no case					
	4					
	3					
	2					
	1 definitely					
Tertiary education is not the standard but advantageous	5 in no case					
	4					
	3					
	2					
	1 definitely					
Tertiary education is the standard	5 in no case					
	4					
	3					
	2					
	1 definitely					
Tertiary education is compulsory	5 in no case					
	4					
	3					
	2					
	1 definitely					

overeducated

overeducated if the occupational status is executive and/or scientific employee, in the upper or higher grade of the civil service

adequately educated

[1] Positional adequacy refers to occupational prestige, income as well as the autonomy range within an occupation

[2] Adequacy according to the level of job design refers to the general cognitive requirements of an occupation

Source: following (Fehse and Kerst, 2007)

Figure A2: Dispersion-index according to Dekker et al. 2002

$$D_e = \left(1 - \sum_{O=1}^{O} \left(\frac{G_{eo}}{G_e}\right)^2\right) \frac{O}{O-1}$$

D_e = dispersion of ISCO-88-occupations (ISCO-88 3-digits) for field of study e
G_{eo} = number of graduates of field e with ISCO-88-occupation o
G_o = number of graduates of field of study e
O = total number of ISCO-88-occupations

Table A1: Allocation of fields of study to ten basic categories

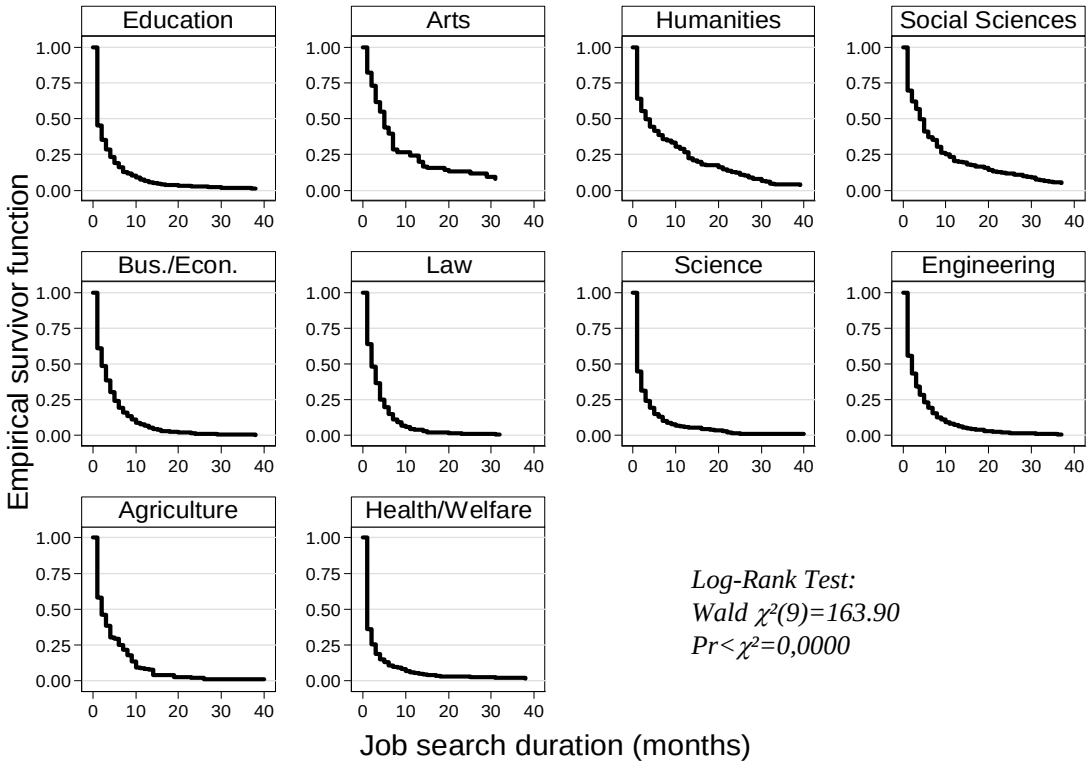
Field of Study	Representative Subjects
1 Education	teaching degree elementary school, teaching degree secondary school, teacher trainers for handicapped children, adult education, education science
2 Arts	arts, design, fine arts, visual arts, sculpture, music
3 Humanities	philosophy, history, librarianship, theology, linguistics, cultural sciences, German language and literature studies, Romance studies, Anglistics, American studies, Slavic studies
4 Social Sciences	sociology, political science, psychology, geography
5 Business/Economics	business studies, economics, industrial engineer, management sciences, public administration
6 Law	law
7 Science	chemistry, physics, astronomy, biology, geology, computer sciences, mathematics
8 Engineering	engineering sciences, mining, engine construction, electrical engineering, traffic engineering, architecture, spatial planning, construction engineering, surveying and mapping
9 Agriculture	agriculture, agricultural technician, forestry and forest product techniques, food technician, veterinary medicine
10 Health and Welfare	human medicine, dentistry, pharmacy, nutritional science, social care, social work

Table A2: Per cent distributions of students in higher education degrees by fields of study

Fields of Study	Staatsexamen	Diplom	Magister	FH
Education	85	12	3	0
Arts	0	18	50	32
Humanities	1	13	79	7
Social Sciences	0	76	24	0
Business/Economics	0	73	0	27
Law	100	0	0	0
Science	0	85	0	15
Engineering	0	40	0	60
Agriculture	53 [2]	17	0	30
Health/Welfare	55	7	0	38
Total	25	40	8	27

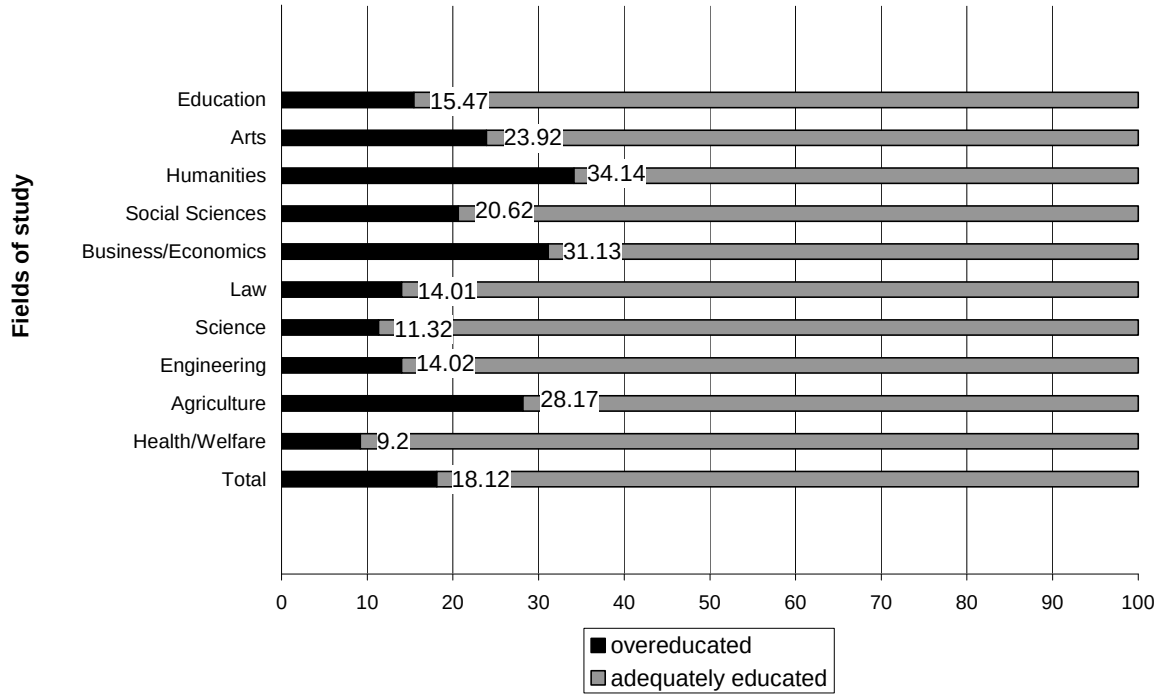
[1] FH ≙ Fachhochschulen (university of applied sciences)
[2]veterinary medicine

Figure 1 Timing of Labour Market Entry by Field of Study, Kaplan-Meier estimates



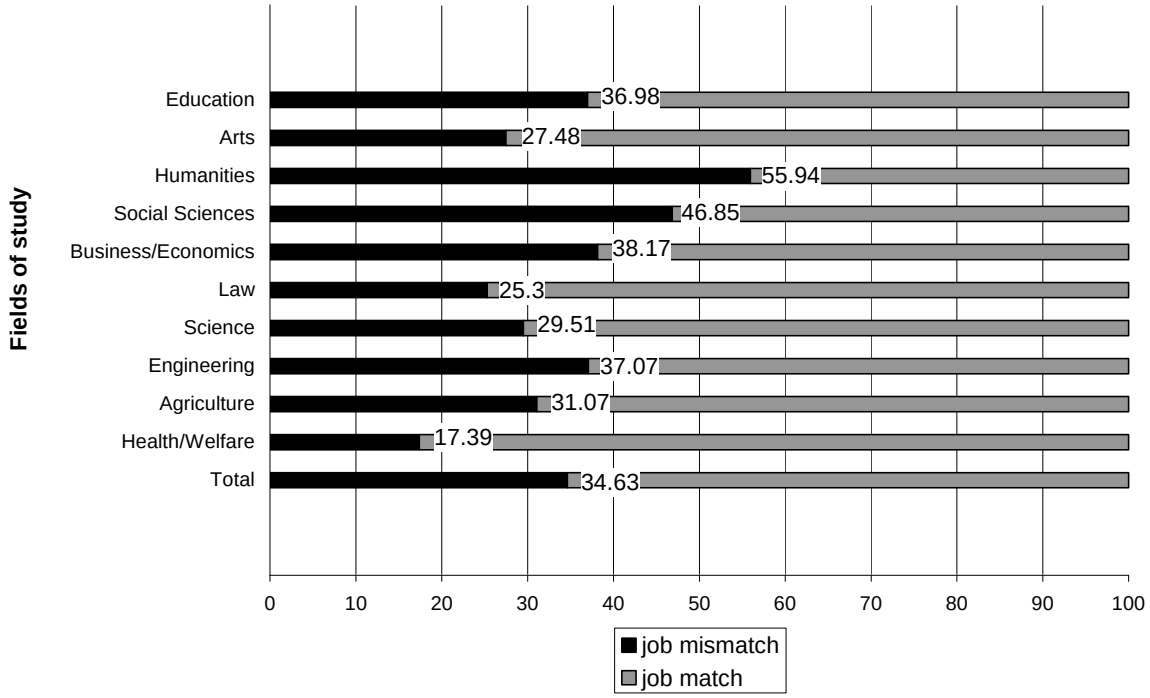
Source: HIS Graduate Panel 1997

Figure 2: Share of Overeducated Employees by Field of Study



Source: HIS Graduate Panel 1997

Figure 3: Share of employees having a job mismatch by field of study



Source: HIS Graduate Panel 1997

Table 1: Non-proportional Cox regression models of the transition into the first significant job: log hazard rate effects (N=4951)

	M1[a]	M2[a]	M3[a]	M4[a]
Field of study (ref. Health/Welfare)				
Education	-0.22***	-0.24***	-0.16**	-0.32***
Arts	-1.03***	-0.95***	-0.89***	-0.67***
Humanities	-0.65***	-0.46***	-0.44***	-0.12
Social sciences	-0.83***	-0.71***	-0.66***	-0.50***
Business/Economics	-0.54***	-0.48***	-0.47***	-0.29***
Law	-0.45***	-0.40***	-0.48***	-0.58***
Science	-0.29***	-0.20***	-0.27***	-0.07
Engineering	-0.56***	-0.57***	-0.48***	-0.28***
Agriculture	-0.61***	-0.61***	-0.49***	-0.43**
Interaction with time				
Education × $\log_2$(time)	0.08	0.09*	0.09*	0.08
Arts × $\log_2$(time)	0.20*	0.20*	0.18*	0.19*
Humanities × $\log_2$(time)	0.10*	0.10*	0.10*	0.08
Social sciences × $\log_2$(time)	0.17***	0.17***	0.17***	0.14**
Business/Economics × $\log_2$(time)	0.27***	0.27***	0.26***	0.24***
Law × $\log_2$(time)	0.33***	0.33***	0.32***	0.30***
Science × $\log_2$(time)	0.09*	0.08	0.07	0.05
Engineering × $\log_2$(time)	0.20***	0.20***	0.19***	0.17***
Agriculture × $\log_2$(time)	0.24**	0.22**	0.22**	0.21**
Specificity measures				
Dispersion (ISCO-88 based)		0.36***	0.31***	0.19**
Content specificity		0.11	0.14	0.23**
Field diversity (ref. Low)				
Middle		-0.30***	-0.30***	-0.25**
High		-0.17	-0.13	0.01
Selectivity measures				
Average 'Abitur' grades			-0.05***	-0.02*
Standard dev. 'Abitur' grades			-0.01	0.00
Type of institution/final degree (ref. Staatsexamen)				
Diplom				-0.34***
Magister				-0.66***
FH				-0.49***
Wald Chi²	411.48***	470.87***	509.03***	585.85***
Df	24	28	30	33

[a]= controlling for final grade, study duration, vocational training, labour market experience, family background, gender; *stratified by* field-specific part-time work, mandatory internships, age at graduation and child at graduation

* $p < 0{,}05$; ** $p < 0{,}01$; *** $p < 0{,}001$

Source: HIS Graduate Panel 1997

Table 2: Logistic regression models of being overeducated in the first significant job (N=3556)

	M1[a]	M2[a]	M3[a]	M4[a]	M5[a]
Constant	-4.85***	-3.49***	-8.64***	-9.64***	-7.96**
Field of study (ref. Health/Welfare)					
Education	0.75**	0.81***	0.54	1.98***	1.84***
Arts	1.59**	1.43*	1.33*	0.94	0.42
Humanities	1.84***	1.44***	1.34***	0.98*	0.44
Social sciences	1.14***	0.75*	0.65*	0.74*	0.29
Business/Economics	1.42***	1.18***	1.19***	0.83**	0.16
Law	0.10	-0.22	0.12	1.51***	1.09*
Science	0.71*	0.38	0.66*	0.14	-0.48
Engineering	0.71**	0.72**	0.46	-0.12	-0.70*
Agriculture	1.57***	1.57***	1.15**	1.11*	0.48
Specificity measures					
Dispersion (ISCO-88 based)		-1.47***	-1.37***	-0.95***	-0.91***
Content specificity		-0.68*	-0.79*	-1.27***	-1.22***
Field diversity (Ref. Low)					
Middle		0.18	0.15	0.22	0.18
High		-0.27	-0.41	-0.60	-0.45
Selectivity measures					
Average 'Abitur' grades			0.17***	0.06	0.05
Standard dev. 'Abitur' grades			0.25	0.42	0.49*
Type of institution/final degree (ref. Staatsexamen)					
Diplom				1.90***	1.79***
Magister				2.11***	1.88***
FH				2.86***	2.64***
Job characteristics					
Temporary (vs. perm. Job)					0.07
Part-time (vs. full-time job)					0.39*
Large firm (vs. small firm)					-0.16
Branch (ref. industry sector)					
Public sector					-1.09***
Private service sector					-0.11
Task specificity					-2.42
Model Chi²	269.2***	312.6***	343.4***	378.8***	416.5***
Df	19	23	25	28	34
Pseudo R²	0.0945	0.110	0.117	0.148	0.170

[a]= controlling for final grade, study duration, vocational training, labour market experience, field-specific part-time work, mandatory internships, family background, gender, age at graduation and child at graduation

* $p < 0{,}05$; ** $p < 0{,}01$; *** $p < 0{,}001$;

Source: HIS Graduate Panel 1997

Table 3: Logistic regression models of having a job mismatch in the first significant job (N=3556)

	M1[a]	M2[a]	M3[a]	M4[a]	M5[a]
Constant	-2.85***	-1.62**	-2.16	-1.68	1.01
Field of study (ref. Health/Welfare)					
Education	1.14***	1.12***	1.15***	1.49***	1.15***
Arts	0.83	0.74	0.76	0.34	-0.19
Humanities	1.70***	1.22***	1.20***	0.58	-0.11
Social sciences	1.44***	1.12***	1.19***	0.91***	0.44
Business/Economics	0.87***	0.76***	0.77***	0.54*	-0.32
Law	0.29	0.00	-0.06	0.25	-0.19
Science	0.91***	0.73***	0.70***	0.41	-0.27
Engineering	1.19***	1.17***	1.19***	0.88***	0.26
Agriculture	0.88**	0.84*	0.85*	0.76*	0.24
Specificity measures					
Dispersion (ISCO-88 based)		-0.79***	-0.81***	-0.60**	-0.65**
Content specificity		-1.51***	-1.51***	-1.63***	-1.63***
Field diversity (ref. Low)					
Middle		0.77**	0.79**	0.68**	0.66*
High		-0.05	-0.05	-0.34	-0.28
Selectivity measures					
Average 'Abitur' grades			-0.00	-0.06	-0.06*
Standard dev. 'Abitur' grades			0.12	0.11	0.17
Type of institution/final degree (ref. Staatsexamen)					
Diplom				0.61*	0.50*
Magister				1.34***	1.13**
FH				0.94***	0.69**
Job characteristics					
Temporary (vs. perm. Job)					-0.13
Part-time (vs. full-time job)					-0.15
Large firm (vs. small firm)					-0.04
Branch (ref. industry sector)					
Public sector					-0.65***
Private service sector					-0.01
Task specificity					-4.67***
Model Chi²	189.8***	248.7***	250.6***	256.4***	340.0***
Df	19	23	25	28	34
Pseudo R²	0.052	0.068	0.068	0.074	0.099

[a]= controlling for final grade, study duration, vocational training, labour market experience, field-specific part-time work, mandatory internships, family background, gender, age at graduation and child at graduation

* $p < 0,05$; ** $p < 0,01$; *** $p < 0,001$

Source: HIS Graduate Panel 1997