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## **Are entrepreneurs made on campus? ? How entrepreneurial orientation of universities influences graduates? occupational choice**

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### **Abstract**

Many universities are becoming more entrepreneurial by supporting spin-off activity of students and staff, installing entrepreneurship programs and creating networks to local entrepreneurs. But how do these activities affect university graduates? employment choices? By utilizing three different data sources this question is addressed in the present study in the case of German university graduates. Information collected through a large-scale graduate survey, implemented by the International Centre for Higher Education Research, is combined with a ranking system of university entrepreneurial orientation and official regional labor data. Empirical analysis suggests that the likelihood of entering self-employment is significantly positively related to the entrepreneurial orientation of the university.

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## 1. Introduction

*The direction in which education starts a man will determine his future. (Plato)*

Many universities increasingly focus on making their organization *more entrepreneurial* by supporting spin-off activity of students and staff, installing entrepreneurship programs and creating networks to local entrepreneurs. But how do these activities affect university graduates' employment choices? Do 'more entrepreneurial' universities yield a relatively higher share of graduates who become self-employed after graduation? Do the best or the worst university graduates enter into self-employment? The present paper addresses these questions in order to investigate to what extent universities' entrepreneurial intention affects occupational choices of its graduates when entering the labor market.

Recent literature has investigated mainly the impact of university entrepreneurship education on *entrepreneurial intention* of students. Existing studies on the effects of entrepreneurship education provide mixed evidence. A recent study by Oosterbeek et al. (2010) indicates that students participating in the leading entrepreneurship program in the Netherlands have lower entrepreneurial intention after partaking in the program. Yet, most studies on this issue rather find the opposite effect with entrepreneurship education increasing students' entrepreneurial intention (e.g. Graevenitz et al. 2010; Souitaris et al. 2007; Fayolle et al. 2006; Peterman and Kennedy, 2003). However, very few studies analyze the impact of the general entrepreneurial orientation of universities – i.e. entrepreneurship services offered by different technology transfer offices – on student's likelihood to become entrepreneurs.

The present study extends this research in two ways. First, the present study analyzes labor market choices of graduates rather than entrepreneurial intention. Second, the present study takes entrepreneurial orientation universities into account – utilizing a ranking on entrepreneurial intention of universities provided by the Ludwig-Maximilians-Universität

Munich on behalf of the German Federal Ministry of Education and Research. This is done to identify whether an *organization* effect of universities exists.

The analysis is based on three data sources. The first, and major, data source is a large-scale graduate survey of German university graduates of 2007 and 2008 conducted by the International Centre for Higher Education Research (INCHER) - Kassel. The second data source is the university ranking on entrepreneurial orientation provided by the Ludwig-Maximilians-Universität (LMU) Munich (Schmude, 2007). This ranking applies an index indicating the entrepreneurial orientation of universities by capturing i.e. assistance for entrepreneurs, entrepreneurship education, and documented spin-offs of the respective university. Finally, the third data source is official data provided by the German Federal Office for Building and Regional Planning. With these three data sources the occupational choice of more than 8,000 graduates who have entered the labor market subsequent to studying can be analyzed in relation to entrepreneurial orientation of the university and regional entrepreneurial activity.

Methodologically, two different empirical analyses are made to analyze which determinants predict the occupational choice of university graduates. First, a two-stage Heckman selection model is applied. In stage 1 of this analysis I analyze which determinants predict the likelihood of a graduate finding a job after graduation. The subsample of graduates with a job is analyzed in stage 2 in order to distinct determinants of self-employment. Both stages of analysis are done with the help of probit regression techniques. Second, aside from the dichotomous choice whether to engage in salaried work or self-employment I also distinguish between five types of occupational choices, namely unemployment, working in the public sector, working for a non-profit organization, working in the private sector and being self-employed. Multinomial logit estimations are performed in order to disentangle whether the entrepreneurial orientation of universities also affects the likelihood of graduates entering,

respectively, the private sector, the public sector, non-profit organizations or self-employment.

Results suggest that entrepreneurial orientation of the university has a robust positive and significant effect on the likelihood that graduates become self-employed. With respect to human capital indicators mixed evidence is provided on the relation of human capital and the likelihood of entering self-employment. On the one hand, the share of self-employed is higher among “A-students”. On the other hand, study performance indicated by grades – relative to other students having graduated in the same field of study is – negatively related the occupational choice of entering self-employment. The latter finding is in line with previous findings by Castagnetti and Rosti (2011) and Dennis (1996). Interestingly, the second stage of analysis reveals that the best students rather self-select into the public sector compared to other types of salaried employment. Furthermore, the share of self-employed individuals in the workforce of the university region is not significantly related to the likelihood of students becoming self-employed.

I conclude that university orientation is a crucial impact on graduates’ occupational choice which might have been underrated in previous literature. From both the regional economic policy perspective and the university management perspective this result opens a debate on how much emphasis a single university should devote to entrepreneurial orientation and to what extent university context may shape occupational choices – and whether such influence is desired.

The remainder of the paper is structured as follows. In section 2 an overview on related literature is provided. Section 3 describes the data sources, sample composition and measurement of variables. The empirical analysis and results are presented in section 4. Finally, section 5 discusses the results and concludes the study.

## **2. Related Literature**

The present study focuses on the impact of entrepreneurial orientation of universities on occupational choices of graduates when entering the labor market after finishing their studies. In doing so, the present study, thereby, relates to three strands of literature. First, it integrates into the emerging body of literature examining the impact of ‘entrepreneurial universities’ on academic entrepreneurship. Second, the study relates to human capital theory by investigating the impact of human capital signals on graduates’ occupational choice. Moreover, the study integrates into labor market economics by investigating the entry into the labor market of a highly qualified workforce. In the following, an overview on related literature is provided.

### *The Entrepreneurial University and Graduate Entrepreneurship*

The transformation process of universities has received increasing attention over the past two decades. Stimulated by external expectation to link university education and research agenda more effectively to the demands of the private sector, university administrators, deans and scientists face the task to transform research universities to entrepreneurial universities (Powers and McDougall, 2005; Cohen et al., 2002). Thereby, leaders of universities are demanded to incorporate effective knowledge transfer to the private sector and to support university spin-offs. University policies are installed to support entrepreneurial activity of graduates and scientists, as, for example, taking equity investments in spin-off companies, establishing founder networks or providing office space for founding teams (Shane, 2004; Di Gregorio and Shane, 2003).

It is widely acknowledged that university spin-off represent an important vehicle to transfer knowledge effectively from universities to the private sector (Zucker et al., 1998, Audretsch and Stephan, 1996). The success of knowledge-intensive start-ups in industries such as biotechnology critically depends on the scientific expertise in such start-ups (McMillan et al. 2000). Furthermore, it is crucial for such firms to either have academics on their start-up team

(Zucker et al., 1998) or to cluster around scientific institutions with expert scientists (Audretsch and Stephan, 1996).

Yet, despite the economic relevance of (some) university spin-offs most studies on academic entrepreneurship rather focus on drivers of entrepreneurial intention rather than actual spin-off formation. Among the few exceptions are studies by Krabel and Mueller (2009) and Landry et al. (2011). Regarding the Max Planck Society in Germany the former study provides evidence that spin-off activity is positively influenced by commercial research orientation of scientists while the latter study indicates that natural and engineering scientists in Canada are more inclined to spin-off when having more research experience. This evidence indicates that entrepreneurial opportunity recognition increases with commercial research orientation and research experience.

In light of these findings two questions evolve with respect to graduate entrepreneurship from universities. First, it remains an open question what antecedents drive graduate entrepreneurship since graduates have hardly any experience in commercial research. Thus, it remains unclear which factors drive entrepreneurial opportunity recognition. Second, while existing evidence suggests that the better – or the more commercialization experienced – scientists are more inclined to entrepreneurship, the question arises whether similar results can be expected for graduates. Is it rather the top or the bottom fraction of graduates who become self-employed? Two opposing arguments serve as a rationale for either of the groups being more likely to become self-employed. On the one hand one could argue that better students are more likely to come up with innovative business ideas. Further, better students may be pulled into entrepreneurship in order to extract higher earnings from their skills. On the other hand, one could argue that worse graduates are pushed into entrepreneurship due to worse outside options on the labor market. The scarce existing evidence rather supports the latter view (Dennis, 1996; Castagnetti and Rosti, 2011).

### *The Impact of Human Capital on Graduates' Employment Choice*

Building upon human capital theory a relatively large body examines the effect of education on individuals' likelihood to become entrepreneurs. Regarding the overall population previous literature provides mixed results on the relation of education and entrepreneurship. By providing a meta-analysis of 94 academic studies Sluis et al. (2003) indicate that overall effect of schooling on self-employment is neither positive nor negative. Here, two opposing effects may cancel each other out. On the one hand, higher education may lead to a greater ability to recognize entrepreneurial opportunity (as e.g. found in Davidsson and Honig, 2003). On the other hand, higher qualification levels may lead to better outside options than entrepreneurship and thus, reducing the attractiveness of entrepreneurship.

Regarding the specific population of university graduates, recent studies have focused on the effect of entrepreneurship-specific education on graduates' entrepreneurial intention. Several studies in this direction build upon the theory of planned behavior (Ajzen, 1991) and relate both the attitude toward becoming self-employed as well as the perceived behavioral control of entrepreneurial activity to the completion of business courses in entrepreneurship. Utilizing a pretest-post-test design Souitaris et al. (2007) provide evidence that science and engineering students in London and Grenoble have a significantly higher intention to become entrepreneurs after completing an entrepreneurship business course as a compulsory or elective module within their curriculum. Inspiration to become entrepreneur is the most influential factor while perceived control of entrepreneurial activity increases slightly. Adopting a comparable research design, Fayolle et al. (2006) also detect that a students' entrepreneurial intention rise after completing entrepreneurship courses while the effect of perceived behavioral control is relatively lower. Further, utilizing a similar research design, Peterman and Kennedy (2003) provide evidence indicating that secondary school students are more likely to find entrepreneurship feasible and desirable when having completed the



enterprise program. Slightly contrasting evidence is provided by Graevenitz et al. (2010) for German Business Administration students in Munich. The latter study indicates that intentions to found a firm decline after completing entrepreneurship courses while the self-assessed entrepreneurial skills are significantly higher. However, these studies focus on entrepreneurial intention rather than tracking whether entrepreneurship education increases the probability to subsequently become founder of a new venture. Furthermore, the general entrepreneurial orientation of universities – i.e. entrepreneurship services offered by different technology transfer offices – on student's likelihood to become entrepreneurs is hardly analyzed.

Moreover, formal education may have an indirect impact on occupational choice as signaling theory indicates that formal education may serve as an instrument for signaling human capital and work productivity (Bedard, 2001; Weiss, 1995). Further, most educational courses – especially in universities – end with graded exams. Thus, graduates may signal quality by completing their studies quickly, by having better grades than other graduates within the same field of study – or by having studied abroad during the course of their studies. Since potential employers prefer to employ qualified or over-qualified candidates to limit the training costs at job entry, quality indicators may ease graduates' chances to receive attractive jobs offers. Thus, quality indicators may influence the decision of graduates when choosing among different job opportunities.

Finally, previous literature has highlighted the likelihood of individuals engaging in entrepreneurial activity relates to the region in which they live. Previous knowledge-based start-up activity in a region breeds further knowledge-based start-up activity (Audretsch and Keilbach, 2007; Audretsch and Keilbach, 2004). Yet, entrepreneurial activity is not homogeneous over space. It might, therefore, be possible that an identical graduate may be less likely to become self-employed when being in a different region with relatively lower regional entrepreneurial activity in the surrounding region.

### **3. Data and Empirical Approach**

#### **3.1. Data Sources**

The analysis of occupational choice of graduates is based three data sources. The first – and primary – data source is a large-scale survey of German university graduates of alumni years 2007 and 2008 when entering the labor market after graduating from university. This survey implementation is part of the KOAB (Kooperationsprojekt Absolventenstudien) project which is a joint research project of the *International Centre for Higher Education Research (INCHER-Kassel)*, located at the University of Kassel and various universities and universities of applied sciences ("Fachhochschulen"). INCHER-Kassel was responsible for survey design and coordination of the graduate tracer study. The universities were responsible for conducting the survey with graduates from their own institution. Thus, universities gathered information of their own graduates while INCHER-Kassel was the sole institution collecting the information of all graduates from over 30 universities included in the study.

Survey implementation was conducted approximately one and a half years after graduation. Graduates who finished their studies in the winter term 2006/2007 or in the summer term 2007 (referred to as alumni year 2007) were surveyed in November/December 2008. The time frame was chosen such that graduates are likely to have entered the labor market when the survey was implemented. Prior to survey implementation graduates were contacted by mail (or postal service if the mail address was unknown) in order to inform them about the survey. Graduates were given the chance to answer the survey either online or by postal service. In doing so, a common core questionnaire was used at all universities with the same questions given to all graduates. However, some optional questions were also given that were not used by all universities. Overall, roughly 20 percent of the questions were optional.

If graduates did not answer the survey they were sent up to three reminders with the request to answer the survey. The survey contained questions on job characteristics and study details as

well as questions personal questions. Information on the job includes i.e. wage, employment status (i.e. self-employment, public servant, or company employee), number of working hours, overall job satisfaction, as well as detailed information on desired job attributes which may affect job satisfaction. With regard to study characteristics I utilize information, on field of study, and final grades. Personal information on gender, age, having children and work experience prior to studying is also used in our analysis.

The second data used is a ranking of the entrepreneurial orientation of universities named “Vom Studenten zum Unternehmer” published by the Ludwig-Maximilian-University Munich (Schmude, 2007; Schmude, 2011). Provided biannually, this ranking is an index combining eight categories which comprise entrepreneurial orientation of an university, namely (1) the extent of entrepreneurship education, (2) extracurricular spin-off support, (3) external networks to entrepreneurship centers and regional entrepreneurs, (4) entrepreneurship policy context at the university, (5) cooperation and coordination – of university internal personnel and resources devoted to entrepreneurship and knowledge transfer, (6) communication – meaning the extent of public announcements of entrepreneurship policies and programs, (7) mobilization of entrepreneurship related initiatives by students and the tribute to success stories and (8) previous spin-off activity.

In each of the eight categories different criteria were measured. For example, university policies encouraging entrepreneurship capture four criteria: The first criterion is the focus on knowledge transfer and entrepreneurship in universities mission statements is considered. A second criterion is the integration of the university in a network which supports entrepreneurship. Third, given a four-point-scale the intensity of university support of start-up activity is considered. Finally, the fourth criterion is the share of the general public funding of universities for personnel which is devoted to entrepreneurship support. According to these four criteria universities were evaluated leading to a certain score – the score of the category

of entrepreneurship policy context at the university. In the overall score, this category is weighted such that it accounts for 10 percent of the overall score. For further details of this ranking composition see Schmude et al. (2011) and Schmude (2007).

Moreover, as a third data source I use the official data of regional characteristics, provided by the German Federal Office for Building and Regional Planning. This institution provides particular data of regional development in economic activity, urban development and demographic composition of German planning regions. I used the data of 2007 and 2008 capturing the share of self-employed as well as the share of employees in creative industries within the regional workforce in the respective university region in the respective year of graduation. These variables are included in order to capture the potential impact of regional entrepreneurial activity on occupational choices of graduates.

### **3.2. Sample composition**

For the empirical analysis a subsample of all graduates included in the survey data of INCHER-Kassel is considered. The reduction of the sample stems from both two major reasons. First, in order to analyze the effect of entrepreneurial orientation of universities on occupational choice it is only possible to consider graduates of universities included in both the graduate study performed by INCHER-Kassel and the university rankings done by the LMU Munich. The intersection of both studies comprises 18 universities which are regarded in the subsequent analysis. Second, specific fields of study have traditionally high or very low self-employment rates due to selecting into specific occupational fields which may bias the results.

Therefore, I excluded graduates in law, human medicine, architecture and teachers from the analysis. Students who become teachers have hardly any occupational choice to make and the share of graduates who become self-employed is traditionally high among medicine, architecture and law students. This is reasoned by the fact that becoming independently

employed as lawyers, doctors or architects is very common and more common than in other fields of study (see e.g. Schomburg and Teichler, 2006).

Further, graduates engaged in further education, i.e. bachelor graduates who subsequently enrolled in master programs are excluded from the analysis as such graduates are not available to the labor market, yet. Moreover, due to missing answers in the survey the overall population of the graduates comprises 8,646 graduates who entered the labor market shape the sample which is analyzed.

### 3.3. Measurement of Variables

#### *Entrepreneurial Orientation of the University*

With regard to the entrepreneurial orientation of the university I rely on information given by the ranking “Vom Studenten zum Unternehmer” provided by the Ludwig-Maximilian-University Munich (Schmude, 2007). This ranking is provided biannually, such that information is given, i.e., for the years 2005 and 2007. I used this data such that for each graduate the last reported index prior to graduation is used. When a graduate starts a firm this spin-off may be captured in the university ranking when regarding the ranking of the same year. Such an overlap is avoided by regarding the last ranking prior to graduation.

- **Entrepreneurial Orientation of university  $j$ :** Based upon the aforementioned ranking I compose a variable reflecting the entrepreneurial orientation of universities. Since items may vary across years I do not count the ranking points of a university, but compute the ratio of ranking points by a specific university and the mean ranking value of participating universities in the given year, or formally, a university  $j$  receives the score

$$EOU_j = \frac{\text{Score : Entrepreneurial Orientation of University } j}{\frac{1}{n} \sum_i^n \text{Score : Entrepreneurial Orientation of University } i}$$

### *Employment*

As demographic control variables I include measures of gender in order to examine whether gender differences in determinants of job satisfaction exist. Further, I use the information whether or not graduates have children, graduates' age of graduates, as well as the information whether graduates are German – indicated by citizenship – and whether graduates have gained work experience in the private sector prior to studying.

- **Employed:** A binary variable is used to indicate by a value of 1 whether the graduate entered regular employment subsequent to studying – not including precarious employment as 400 Euro jobs being exempt from tax and social security.
- **Self-Employment:** This binary variable denotes whether a graduate is self-employed, by a value of 1, or entered salaried work, by a value of 0.

### *Demographic characteristics*

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- **Female:** A binary variable is used to indicate the gender of a graduate. This measure is coded with a value of 1 if a graduate is female while a value of 0 indicates a male graduate.
- **Having children:** This binary variable denotes whether a graduate has children in her or his household (value of 1) or not (value of 0).
- **Age:** This variable indicates graduates' age at the time of the interview (end of 2008).
- **German citizenship:** A binary variables indicates whether or not a graduate has a German citizenship, denoted by a value of 1, or not – denoted by a value of 0.
- **Work experience prior to study:** A further binary variables indicates whether or not a graduate finished a vocational training (=1 if vocational training is finished).

### *Quality Indicators*

Two indicators used as quality signals in the analysis. Indicators relating to grades are discussed below. Further I use indicators relating to international study experience and information whether or not graduates achieved to finish their studies within the standard period of study. These two indicators reflect graduates' willingness to accept the challenge to work in unknown environments in foreign countries and graduates and their determination at work, respectively.

- **Visiting semester at university abroad:** This binary variable indicates by value of 1 whether or not a graduate went to study at least one semester at a foreign university.
- **Difference to average grade:** This variable is used as a proxy of the quality of graduate. In the German education system grades range from 1.0 to 4.0 with 1.0 denoting "excellent" and 4.0 denoting "still sufficient". Yet, as grades may differ systematically across disciplines and universities, I utilize *differences* of own final grade to average grades to the average grade within graduates' field of study.

$$Diference\ to\ averge\ grade_k = (-1) * \left( Final\ grade\ of\ graduate\ k - \frac{\sum_{l=1}^m Final\ grade\ of\ graduate\ l}{m} \right)$$

with graduates  $k, l$  belonging to the same field of study. Note that the multiplication with -1 recodes the differences to average grade such that higher values of differences to the average grade indicate that students are relatively better.

### *Field of study*

- **Field of study:** I distinguish between 13 different fields of study. This is done by the use of 13 binary variables indicating, respectively, that a graduate studied in the field of (1) linguistics, (2) psychology, (3) sport sciences, (4) social sciences, (5) economics or business studies, (6) mathematics or computer sciences, (7) physics, (8) biology, chemistry or pharmaceutical studies, (9) geology or geography, (10) veterinary, (11) agriculture or forestry sciences, (12) engineering or (13) in any remaining subject.

### *Regional Workforce*

In order to proxy the extent to which graduates may be drawn into self-employment by regional patterns I rely on the information how frequent self-employment is in the university region. This regional information is provided by the German Federal Office for Building and Regional Planning.

- **Number of Self-Employed per 100 workers in regional workforce:** This variable measures how many workers – indicated by social insurance and tax pay – are self-employed within the planning region in which the university is located. To account for regional disparities in size the percentage of workers who work in creative industries in the regional workforce is given.

In Table 1 an overview of variables is given for the sample used in the empirical analysis.

**Table 1: Overview of Variables**

	<i>Min Value</i>	<i>Max Value</i>	<i>Mean Value</i>	<i>Stand.Dev.</i>
<i>Entrepreneurial Orientation of University</i>	0.6135	1.6601	1.000	0.182
<i>Employed</i>	0	1	0.7981	0.401
<i>Self-employed</i>	0	1	0.090	0.286
<b><i>Demographics</i></b>				
<i>Female</i>	0	1	0.467	0.498
<i>Having Children</i>	0	1	0.123	0.328
<i>Age</i>	21	57	29.78	4.86
<i>German Citizenship</i>	0	1	0.937	0.243
<i>Work experience prior to study</i>	0	1	0.479	0.499
<b><i>Quality Signals</i></b>				
<i>Difference to average grade</i>	-0.867	2.133	-0.010	0.584
<i>Visiting semester at university abroad</i>	0	1	0.398	0.489
<b><i>Field of Study</i></b>				
<i>Linguistics</i>	0	1	0.149	0.334
<i>Psychology</i>	0	1	0.035	0.171
<i>Sport Sciences</i>	0	1	0.012	0.103
<i>Social Sciences</i>	0	1	0.108	0.289
<i>Economics Business Studies</i>	0	1	0.207	0.382
<i>Math / Computer Sciences</i>	0	1	0.138	0.323
<i>Physics</i>	0	1	0.026	0.150
<i>Biology / Chemistry / Pharmaceuticals</i>	0	1	0.109	0.291
<i>Geology / Geography</i>	0	1	0.032	0.165
<i>Veterinary</i>	0	1	0.002	0.042
<i>Agriculture Sciences</i>	0	1	0.017	0.121
<i>Engineering</i>	0	1	0.118	0.301
<i>Remaining subjects</i>	0	1	0.041	0.035
<i>Number of Self-Employed per 100 workers in regional workforce</i>	9.1	14.1	10.623	0.957



## 4. Results

### 4.1. Descriptive Results

In order to reflect to what extent entrepreneurial orientation of the university and graduates' quality influence the likelihood of a graduate to become self-employed I first make a simple comparison. In the first line of Table 2 it is indicated how many graduates enter salaried employment and how many graduates become self-employed in the overall sample analyzed. The share of self-employed is also given. Subsequently, I compare these numbers with the respective numbers in the subsamples of (i) "A"-students, who graduated with a final grade of 1 (which indicates a "very good" exam), the best possible grade in the German grading system, (ii) students who went abroad to study at a foreign university during their studies and (iii) the subsample of graduates belonging to the three most entrepreneurial universities in the sample – according to the aforementioned ranking of universities. The evidence shows that among "A-students" self-employment is relatively higher compared to the overall population of students with around 9.6% of "A-students" becoming self-employed. A slightly lower share of graduates who went abroad during their studies becomes self-employed. Yet, most noteworthy, among the three most entrepreneurial universities the share of graduates becoming self-employed is one percentage point higher than in the overall population, meaning an increase of roughly 11% taking the overall population as the baseline for comparison.

**Table 2: Descriptive Evidence**

	<i>Salaried Employment</i>	<i>Self-employed</i>	<i>Share of self-employed</i>
Overall	7846	800	9.2%
"A" students	3762	400	9.6%
Visiting semester at university abroad	3061	285	8.5%
3 most entrepreneurial universities	691	77	10.2%

In Table 3 a correlation matrix of entrepreneurial orientation of the universities and personal characteristics of graduates is given. Comparing the correlations it is evident that correlations are rather low. Note that the low correlation of entrepreneurial orientation of universities and self-employment does not contradict the previous finding that the share of self-employed is very high among the most entrepreneurial universities. Across universities the share of self-employment is lower than salaried work such that the correlation largely influence by graduates who have entered salaried work.

**Table 3: Correlation Matrix**

	C1	C2	C3	C4	C5	C6
<i>Entrepreneurial Orientation of the University (C1)</i>	1.000					
<i>Self-employment (C2)</i>	0.0156*	1.000				
<i>Female (C3)</i>	-0.0866*	0.0271	1.000			
<i>Age (C4)</i>	0.0913*	0.1832*	-0.0542*	1.000		
<i>Having children (C5)</i>	0.0562*	0.0600*	-0.0079	0.3597*	1.000	
<i>Visiting semester abroad (C6)</i>	-0.0979*	-0.0161*	0.0312*	-0.1335*	-0.0948*	1.000
<i>Difference to average grade (C7)</i>	-0.0112	-0.0208*	0.0040*	-0.0143	0.0123	-0.0547*

Notes: The total sample comprises 8,646 graduates. The asterisk \* denotes significance of the pairwise correlation at the one percent level

## 4.2. Empirical Analysis

The empirical analysis proceeds in two steps. First, I analyze the dichotomous choice of graduates to become self-employed or to enter salaried employment. Second, I analyze occupational choice of graduates subsequent to finishing their studies by distinguishing unemployment, (ii) working in the public sector, (iii) working for a non-profit organization, (iv) working in the private sector and (v) being self-employed. This analysis is performed in order to shed further light, on i.e. the question whether entrepreneurial orientation of the university and regional entrepreneurship capital increases the likelihood that graduates self-select rather in the private sector than in public or non-profit organizations.

In the first step the likelihood of entering self-employment is analyzed with the help of probit regression techniques. However, the sample of employed graduates is a subsample of the overall population since some graduates are selected in the group of unemployed. In order to correct for this selection mechanism I utilize a regression technique proposed by Heckman (1979). This technique comprises two stages of analysis. In a first stage the likelihood to get a job is analyzed. Then, the inverse Mill's ratio is calculated and included in the second stage – investigating determinants of self-employment. Moreover, the estimates are clustered for the 18 universities considered in the analysis. As the first stage is not of particular interest for the purpose of this study the results are given in the appendix in Table A2, but are not discussed in detail here. In the second stage of analysis the likelihood of being self-employed is analyzed, also with the help of probit regression technique. Results are given in Table 4.

The first model solely comprises entrepreneurial orientation of the university and personal characteristics of the graduate as explanatory variables. The second model includes the same set of explanatory variables and additionally adds controls for field of study. Finally, the third model comprises all variables of the second model and also includes variables reflecting the regional workforce. For all three models both coefficients and marginal effects are provided.

Results suggest that more entrepreneurial universities yield higher rates of self-employment subsequent to studying. The marginal effect in model 2b suggests that the likelihood of becoming self-employed increases by 3.50 percent if the entrepreneurial orientation score of the university increases by one standard deviation point. To make this number more feasible: If the same student decides to study the same subject at the most entrepreneurial university in the sample compared to the least entrepreneurial university in the sample then her or his chance of becoming self-employed subsequent to studying increases by 20 percent – holding all other characteristics constant. Thus, universities' effort to support entrepreneurial activity and to create networks to entrepreneurs does affect the occupation choice of graduates.

**Table 4: Probit Regressions on the Likelihood of Entering Self-Employment**

Variables / Models	(1a) Coefficient	(1b) Marg. Eff.	(2a) Coefficient	(2b) Marg. Eff.	(3a) Coefficient	(3b) Marg. Eff.
<i>Entrepreneurial Orientation of the University</i>	0.384*** (0.123)	0.0590*** (0.0212)	0.292** (0.132)	0.0350** (0.0158)	0.294** (0.132)	0.0352** (0.0159)
<b>Demographics</b>						
<i>Female</i>	0.0707 (0.0437)	0.00935 (0.00735)	-0.0105 (0.0477)	-0.00126 (0.00571)	-0.0104 (0.0478)	-0.00125 (0.00571)
<i>Having Children</i>	-0.0821 (0.0623)	-0.0249*** (0.00867)	0.140** (0.0674)	0.0182* (0.00949)	0.144** (0.0676)	0.0188** (0.00957)
<i>Age</i>	0.0565*** (0.00390)	0.0110*** (0.000721)	0.00634 (0.00550)	0.000760 (0.000661)	0.00670 (0.00552)	0.000803 (0.000663)
<i>German Citizenship</i>	0.0883 (0.0848)	0.0168 (0.0122)	-0.342*** (0.0944)	-0.0514*** (0.0172)	-0.346*** (0.0945)	-0.0520*** (0.0173)
<i>Work experience prior to study</i>	0.196*** (0.0417)	0.0262*** (0.00690)	0.178*** (0.0437)	0.0215*** (0.00532)	0.177*** (0.0437)	0.0213*** (0.00532)
<b>Quality Signals</b>						
<i>Difference to average grade</i>	-0.0647* (0.0362)	-0.00833 (0.00595)	0.111*** (0.0405)	0.0132*** (0.00485)	0.109*** (0.0406)	0.0131*** (0.00486)
<i>Visiting semester at university abroad</i>	0.0190 (0.0433)	0.00662 (0.00720)	-0.202*** (0.0486)	-0.0234*** (0.00547)	-0.203*** (0.0486)	-0.0235*** (0.00547)
<b>Regional Workforce</b>						
<i>Share of Self-employed in Regional Workforce</i>					-0.0183 (0.0220)	-0.00220 (0.00264)
<i>Field of Study Controls</i>	NO	NO	YES	YES	YES	YES
<i>Inverse Mills Ratio included</i>	0.341** (0.137)	0.152*** (0.0227)	-3.324*** (0.340)	-0.398*** (0.0407)	-3.335*** (0.340)	-0.399*** (0.0408)
<i>Constant</i>	-3.822*** (0.216)		-1.348*** (0.299)		-1.162*** (0.373)	
Observations	8,646	8,646	8,646	8,646	8,646	8,646
R2 (McKelvey)	0.084		0.183		0.183	
Log Likelihood	-2289	-1986	-2130	-2130	-2129	-2129

Standard errors in parentheses, Asterisks denote significance levels: \*\*\* p<0.01.; \*\* p<0.05.; \* p<0.1

A further noteworthy finding is that the negative effect of grades on self-employment in the first model indicates that rather the best students enter self-employment since the variable difference to average grade is coded such that lower scores represent better students. However, the effect switches signs when adding controls for field of study as further explanatory variables. Furthermore, the inverse Mill's ratio has a negative and significant impact on the likelihood of entering self-employment. This leaves room for the interpretation that it is rather the worse students – indicated by grades – who become self-employed in response to worse outside options. As very good grades are awarded relatively more often in social sciences the positive effect of grades in the first two models – which do not account for field of study – might be misleading. Finally, evidence suggests that graduates with work experience prior to studying are more entrepreneurial than their counterparts without this experience.

Results of the multinomial logit regression analysis are reported in Table 5. Findings suggest that occupational choice is largely influenced by field of study. Graduates' job opportunities are clearly pre-selected by the different subjects studied. For example, graduates from social sciences seem to hardly find a job in the private sector such that all other occupational choices are significantly more likely to occur. Furthermore, female graduates are significantly more likely to both not having a regular job at all and to enter the public sector, respectively, compared to having a job in the private sector. In line with the findings of the probit analysis entrepreneurial orientation of the university largely influences the likelihood of becoming self-employed. Graduates with good grades rather enter the public sector. Interestingly, visiting a semester abroad is positively related to the likelihood that graduates enter salaried employment in the private sector, indicated by the negative and significant relation of other categories to the base category, defined as work in the private sector.

**Table 5: Multinomial Logit Regression on occupational choice**

	(1) No regular employment	(2) Public Sector	(3) Non-profit Sector	(4) Private Sector	(5) Self- employed
<i>Entrepreneurial Orientation of the University</i>	-0.000627 (0.00112)	-0.00174 (0.00107)	0.00197 (0.00221)		0.0167*** (0.00205)
<i>Female</i>	0.151** (0.0692)	0.243*** (0.0663)	0.0904 (0.128)		-0.140 (0.125)
<i>Having Children</i>	0.487*** (0.107)	0.261*** (0.0978)	0.578*** (0.165)		0.0528 (0.168)
<i>Age</i>	-0.0754*** (0.00924)	0.0284*** (0.00685)	0.0356*** (0.0107)		0.0689*** (0.00939)
<i>German Citizenship</i>	-0.556*** (0.124)	-0.186 (0.126)	-0.173 (0.259)		-0.0404 (0.249)
<i>Work experience prior to study</i>	-0.135** (0.0639)	-0.116* (0.0612)	-0.145 (0.126)		0.149 (0.121)
<i>Difference to average grade</i>	-0.00557 (0.0574)	-0.421*** (0.0586)	-0.0373 (0.109)		-0.0599 (0.101)
<i>Visiting semester abroad</i>	-0.353*** (0.0670)	-0.0805 (0.0635)	-0.328** (0.132)		-0.403*** (0.130)
<i>Linguistics</i>	2.311*** (0.114)	1.612*** (0.116)	1.894*** (0.237)		1.893*** (0.189)
<i>Psychology</i>	1.406*** (0.209)	1.859*** (0.167)	2.163*** (0.305)		1.572*** (0.282)
<i>Sports / Arts</i>	2.039*** (0.276)	2.026*** (0.264)	3.010*** (0.378)		1.804*** (0.476)
<i>Social Sciences</i>	2.078*** (0.126)	1.851*** (0.123)	3.032*** (0.218)		1.292*** (0.219)
<i>Economics Business Studies</i>	Reference Category	Reference Category	Reference Category	Reference Category	Reference Category
<i>Math / Computer Sciences</i>	0.485*** (0.127)	1.005*** (0.112)	-1.767*** (0.608)		0.220 (0.218)
<i>Physics</i>	2.044*** (0.182)	1.689*** (0.184)	0.404 (0.619)		0.413 (0.486)
<i>Biology / Chemistry</i>	1.994*** (0.121)	1.709*** (0.120)	0.428 (0.344)		0.701*** (0.251)
<i>Geology / Geography</i>	1.755*** (0.175)	1.635*** (0.166)	1.230*** (0.395)		0.184 (0.480)
<i>Veterinary</i>	-0.000316 (1.056)	0.474 (0.665)	-11.05 (399.0)		1.152* (0.622)
<i>Agriculture Sciences</i>	1.921*** (0.219)	1.120*** (0.253)	2.084*** (0.369)		1.781*** (0.325)
<i>Engineering</i>	0.218 (0.140)	0.721*** (0.120)	-0.566 (0.372)		-0.767*** (0.281)
<i>Remaining subjects</i>	2.577** (1.014)	2.302*** (0.877)	3.375*** (1.033)		3.137*** (0.956)
<i>Constant</i>	0.629* (0.349)	-2.528*** (0.304)	-4.963*** (0.573)		-8.055*** (0.547)
Observations	8,646	8,646	8,646	8,646	8,646
R2 (MacFadden'S adjusted)	0.1129				
Log Likelihood	-9466.6004				

Standard errors in parentheses, Asterisks denote significance levels: \*\*\* p<0.01.; \*\* p<0.05.; \* p<0.1

### 4.3 Robustness Checks

The evidence presented so far indicates that entrepreneurial orientation of universities does impact the occupational choice of graduates. Yet, one might argue that this effect is driven by a self-selection process driving students with high individual entrepreneurial orientation to study at universities which put greater emphasis on entrepreneurship support. If this was true, however, it would mean that such students deliberately move to universities with great emphasis on entrepreneurship. In order to verify if there is evidence in favor of this argument of reverse causality additional regressions were performed on the subsample of students in business administration. Prior to 2005 business administration – as medicine and law students – did not apply to single universities in Germany, but to the so-called ‘Zentrale Vergabestelle’ (ZVS). Since the number of potential students in these disciplines exceeded (and still exceeds) the number of spots available the ZVS was installed as an agency which is responsible for collecting national applications and allocating available spots to the best students applying. Thus, a student was not able to decide where to study her- or himself, but students had to accept the allocation (and, thus, location) decision of the ZVS. When running additional regressions on the subsample of graduates who were allocated by the ZVS it turns out that the effect of entrepreneurial university orientation remains significant.<sup>1</sup> However, due to the small sample size of business administration students in the overall sample these results need to be cautiously interpreted. Moreover, I have tested whether entrepreneurial orientation of the university affects the likelihood of becoming self-employed in the subsample of graduates who finished school in the same region as they studied in. Again, entrepreneurial orientation of the university remains significant. This evidence points toward an effect of university context on the likelihood of graduates to become self-employed rather than a pre-selection-mechanism that attracts ‘entrepreneurial’ students to study at universities with high emphasis on entrepreneurship support.

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<sup>1</sup> Results are available upon request.

## **5. Discussion and Conclusion**

The purpose of this study was to investigate the effect of university efforts to become more 'entrepreneurial' on the occupational choice of graduates. In doing so, I combine the established measure of entrepreneurial orientation of universities provided by the Ludwig-Maximilian-University in Munich (Schmude, 2007) and graduate survey information collected by INCHER-Kassel. The results of the present study indicate that an organization effect exists in the sense that entrepreneurial orientation of universities – comprising different types of university efforts to foster spin-off activity – does affect graduates' likelihood of becoming self-employed.

This key result has several important implications. First, from a policy perspective this result provides evidence that – if desired – then an increase in self-employment might be partly fostered by regional initiatives to link universities and the private sector. Moreover, public funding schemes aimed to make universities more entrepreneurial may have an indirect influence on labor markets of graduates. Second, from university managers' perspective the result provide clear indication that the efforts put into support of entrepreneurial activity leads to higher exploitation of entrepreneurial opportunities. Therefore, deans and university administrators have a benchmark to what extent the strategic orientation of university affects graduates' subsequent behavior. Third, from students' point of view the choice of university may become even more crucial and complex, since an additional aspect could be considered. Apart from regional preferences and availability of the desired field of study, students may also relate the choice at which university to study to the support of entrepreneurial activity – if this is a feasible career option. Thus, entrepreneurial orientation may – to some extent – become a further aspect in university competition for high potential students. Yet, the positive effect of entrepreneurial orientation on graduates' likelihood to enter self-employment must



also be interpreted in combination with the finding that rather the worse students enter self-employment when controlling for field of study.

Two further findings are noteworthy. First, multinomial logit regression analysis reveals that the best students rather self-select into the public sector than to the private sector work. This finding could be interpreted as public administration in Germany having less difficulty in selecting the best students than commonly expected. Furthermore, the share of self-employed individuals in the workforce of the university region is not significantly related to the likelihood of students becoming self-employed.

Finally, while providing evidence on graduates' likelihood of becoming self-employed this study does not have any information on the outcome of self-employment. In order to provide a clear policy recommendation on the economic effects of graduate self-employment it is necessary to gather further information, i.e. on whether graduates' employ other workers or whether or not they leave self-employment relatively soon. As such information is beyond the scope and possibilities of the present study I highly encourage further research on graduates' labor market choices in order to yield further important insights, especially on potential effects of university context.

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## Appendix

**A1: Table A1 – Ranking: Entrepreneurial Orientation of Universities in 2007**

University	Score of Categories								Total Points
	1	2	3	4	5	6	7	8	
1. University of Wuppertal	56	30	23	32	31	26	54	24	276
2. University of Potsdam	47	43	32	25	31	29	53	13	273
3. Technical University Dresden	29	45	32	26	31	21	60	20	264
4. Technical University Munich	52	42	33	19	30	20	46	19	261
5. Otto-van-Guericke University Magdeburg	55	30	32	25	26	15	40	17	240
6. Ludwig-Maximilians-Universität München	23	45	32	32	36	17	40	13	238
7. University of Lüneburg	60	39	26	19	33	28	22	10	237
8. Technical University Berlin	20	42	32	25	24	27	49	17	236
8. Universität Duisburg-Essen	51	41	35	19	34	22	28	6	236
10. Brandenburgische University of Technology, Cottbus	31	28	25	25	35	12	55	23	234
10. University of Hohenheim	35	39	31	20	35	16	47	11	234
...	...	...	...	...	...	...	...	...	...

*Source: Numbers adopted from Schmude (2007)*

### Categories:

- (1) the extent of entrepreneurship education
- (2) extracurricular spin-off support
- (3) external networks to entrepreneurship centers and regional entrepreneurs
- (4) entrepreneurship policy context at the university
- (5) cooperation and coordination – personnel and resources devoted to entrepreneurship support
- (6) communication – public announcements of entrepreneurship policies and programs
- (7) mobilization of entrepreneurship related initiatives
- (8) previous spin-off activity

**A2: Table A2 – First Stage Analysis on the Likelihood of Being Employed**

	(1) Coefficient	(2) Marg. Eff.
<b>Demographics</b>		
<i>Female</i>	-0.166*** (0.0392)	-0.0372*** (0.00703)
<i>Having Children</i>	-0.222*** (0.0538)	-0.0501*** (0.0108)
<i>Age</i>	0.0272*** (0.0102)	0.00629*** (0.00216)
<i>German citizenship</i>	0.290*** (0.0804)	0.0713*** (0.0203)
<b>Quality Signals</b>		
<i>Difference to average grade (university)</i>	-0.0882*** (0.0269)	-0.0273*** (0.00534)
<i>Visiting Semester Abroad</i>	0.142*** (0.0335)	0.0186* (0.00984)
<b>Field of Study</b>		
<i>Linguistics</i>	-0.591*** (0.0842)	-0.132*** (0.0229)
<i>Psychology</i>	-0.0386 (0.146)	-0.00662 (0.0255)
<i>Sports / Arts</i>	-0.647** (0.323)	-0.157 (0.102)
<i>Social Sciences</i>	-0.462*** (0.101)	-0.0979*** (0.0235)
<i>Economics Business Studies</i>	<i>Reference</i>	
<i>Math / Computer Sciences</i>	-0.0810 (0.116)	-0.0142 (0.0211)
<i>Physics</i>	-0.310* (0.180)	-0.0627 (0.0424)
<i>Biology / Chemistry</i>	-0.357*** (0.137)	-0.0725** (0.0322)
<i>Geology / Geography</i>	-0.471*** (0.0871)	-0.104*** (0.0235)
<i>Agriculture Sciences</i>	-0.107 (0.128)	-0.0192 (0.0240)
<i>Engineering</i>	0.125 (0.0907)	0.0196 (0.0139)
<i>Remaining subjects</i>	-0.159 (0.438)	-0.0295 (0.0894)
<i>Constant</i>	0.187 (0.316)	
Observations	10,371	
R2 (McKelvey)	0.136	
Log Likelihood	-10,169	

Robust standard errors in parentheses

\*\*\* p&lt;0.01. \*\* p&lt;0.05. \* p&lt;0.1