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Here Today, Gone Tomorrow? Regional Labor Mobility of German University Graduates

Stefan Krabel
University of Kassel
Institute of Economics
krabel@uni-kassel.de

Abstract

In this study we trace university graduates? labor mobility when entering the labor market after graduation. We examine to what extent such mobility is determined by regional factors of the university region, personal characteristics of graduates as well as their field of study.. Our analysis is based on a large-scale dataset of labor market mobility of individuals who graduated from 36 German universities in 2007. Our results suggest that graduates are less likely to leave metropolises and that regional labor markets influence mobility. Further, field of study and individual willingness to be mobile, as indicated by prior mobility from school to university and mobility during the studies, impact mobility when entering the labor market. These results indicate that both regional and individual factors influence graduate mobility. Moreover, by applying a two-stage model approach we find that mobility is mediated by the probability to find regular employment.

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Abstract

In this study we trace university graduates' labor mobility when entering the labor market after graduation. We examine to what extent such mobility is determined by regional factors of the university region, personal characteristics of graduates as well as their field of study.. Our analysis is based on a large-scale dataset of labor market mobility of individuals who graduated from 36 German universities in 2007. Our results suggest that graduates are less likely to leave metropolises and that regional labor markets influence mobility. Further, field of study and individual willingness to be mobile, as indicated by prior mobility from school to university and mobility during the studies, impact mobility when entering the labor market. These results indicate that both regional and individual factors influence graduate mobility. Moreover, by applying a two-stage model approach we find that mobility is mediated by the probability to find regular employment.

1. Introduction

My prom night is over! So, where do I (want to) go after graduating from university? Many students around the world ask themselves this question when completing their studies. The consequences of the answers are manifold. Regional labor mobility of graduates – when entering regular employment after graduation – is of great importance to both leaders of higher education organizations and regional economic policymakers. From an economic perspective universities are often argued to contribute to region's innovative capability (e.g. Faggian and McCann, 2009; Aula and Harmaakorpi, 2008; Cooke, 2002). Therefore, policy makers assign universities the role of economic actors in the sense that knowledge is transferred to the private sector and a highly qualified workforce for the region is educated (Srinivas and Viljamaa, 2008; Cohen et al., 2002). Moreover, in many countries funding systems for academic institutions require states to provide a large fraction of the funding. Thus, states may either suffer or benefit from, respectively, the relative outflow or inflow of university graduates (Bound et al., 2004). Thus, geographic and cross-state mobility of university graduates when entering the labor market is of crucial importance to the design of economic policies for regions (or states) and the location planning of universities.

It is widely acknowledged that regions benefit from investments in higher education and research (see e.g. Abramovsky et al. 2007; Rondé and Hussler, 2005). One of the benefits from higher education is the knowledge transfer from academia to industry. Graduates are thought to increase the qualification level of the regional labor force and to apply their knowledge and skills to the local firms (Chatterji, 1999). In doing so, graduates may strengthen the absorptive capacity of the private sector and, thus, lead to improved innovative and economic performance (Fritsch and Slavtchev 2007; Kaufmann and Tödtling, 2000). However, the latter rationale assumes that a substantial share of graduates remain in their university region after completing their studies. As this may not always be the case mobility patterns of university graduates have recently received increasing attention in

regional economics and economic geography (Venhorst et al. 2010; Hoare and Corver, 2008; Smith et al. 2000).

Previous evidence provides mixed evidence on the share of graduates who remain in their university region after finishing their studies. Several studies detect that labor mobility among university graduates is relatively high (see e.g. Bound and Holzer, 2000; Groen, 2004 for the US; Hoare and Corver, 2008 for the UK) while other studies show that mobility of academics is relatively low (Stephan, 2005; for doctoral students in the US; Belfield and Morris, 1999 in the case of British graduates). Furthermore, prior research on graduate mobility suggests that the likelihood of graduates moving from one region to another may be influenced by various determinants including individual human capital (Faggian and McCann, 2009; Groen, 2004), previous mobility (Belfield and Morris, 1999), as well as characteristics of the university region (Hansen et al. 2003; Korzycki, 2001). However, as most studies focus on specific groups of graduates – e.g. alumni of a specific region or of a specific field of study – our knowledge on the extent of graduate mobility and determinants of labor mobility is insufficient.

The present study aims to contribute to our understanding on determinants of graduate mobility by investigating the relative impact of regional economic characteristics – in comparison to graduates' individual characteristics and their field of study – on labor mobility. Combining previous empirical findings and theoretical works on graduate labor markets we derive an empirical model of determinants of mobility patterns. We, then, test this model within a large dataset of over 10,000 university graduates from German universities who completed their studies either in winter term 2006/2007 or in summer term 2007. Of these graduates we regard the first employment in regular jobs taken no later than December, 2008.

Our results suggest that labor market prospects for highly qualified in the university region significantly affect graduate mobility. Further, previous mobility (i.e. from school to university) is positively related to labor mobility whereas graduates from universities in

metropolitan areas are less likely to move elsewhere. Finally, female students tend to be more mobile while graduates with children are less likely to leave the region.

The remainder of the paper is structured as follows. Section 2 provides a literature overview on factors influencing graduate labor mobility and a two-stage-model capturing the different determinants. In section 3, the data and the empirical approach are described while the results of our analysis are discussed in section 4. Finally, section 5 concludes our study.

2. Determinants of graduate labor mobility

In general, labor mobility is found to increase with qualification (Lehmer and Ludsteck, 2008). Thus, some studies detect that a substantial portion of university graduates is employed in a different state than their university (e.g. Kodrzycki, 2001; Groen, 2004). Yet, some studies detect contrary results indicating that graduates from universities tend to accept a job within their university region, if possible. Stephan et al. (2005) i.e. provide evidence that U.S. doctoral programs comprise large groups of regional university graduates. This finding suggests that doctoral students tend to work at their home institutions or home region. Furthermore, immobility appears to be especially pronounced among founders. Entrepreneurship studies in different industries provide evidence that the majority of entrepreneurs found new companies in their (at the time of founding) present home region, indicated either by living or employment (e.g. Figuereido et al., 2002; Dahl and Sorenson, 2008). This finding also holds when concentrating on academic entrepreneurship, exclusively (Slavtchev and Heblich, 2010). A recent study by Martin-Brelot et al. (2010) shows evidence, that the 'creative workers' in the main European metropolitan areas are much lesser mobile, than expected. Yet, most of the above sketched studies focus on particular aspects of mobility while only few studies provide a comprehensive analysis of mobility comprising individual, regional and institutional indicators that might affect mobility patterns. In the following we provide a modeling approach that enables us to investigate the impact of

regional characteristics, as well as individuals attributes, on mobility patterns in a two-stage model.

- *Determinants of graduate labor mobility: A modeling approach*

An analysis of graduate labor mobility must account for several factors. On the one hand, individual factors may shape the willingness to move away from the home region. Some studies stress the importance of individual attitudes towards mobility, the perception of structural factors as well as individual facilities within models of mobility, as health problems (Schneider and Meil 2008, Hansen et al. 2003). On the other hand, regional labor markets and subject of studying may influence the likelihood that graduates find a job locally (e.g. Venhorst et al. 2010, Hansen et al. 2003)

We review existent literature on determinants of labor mobility among the highly-qualified workforce and derive what determinants are expected to determinants shape individuals to accept jobs outside their home region. Our model specifies that

$$M_i = f(R_i, D_i, S_i, E_i) \qquad (1)$$

where M_{ij} denotes the individual labor mobility of indidual i who graduated in region j which is modeled as a function of regional characteristics of the university region (R_i), socio-demographic characteristics of individuals (D_i), idiosyncratic studying specifics as field of study as well as studying success (S_i), and employability of individual i, denoted by E_i. Thereby, we account for the fact that employability of individuals, in turn, also depends on study characteristics and socio-demographics of individuals

$$E_i = f(R_i, D_i, S_i) \qquad (2)$$

Investigating mobility patterns in this two-stage analysis allows us to disentangle to what extent regional economic indicators impact mobility patterns directly or indirectly (via their influence on employability). Moreover, such a two-stage analysis also allows us to identify the relative importance of regional characteristics – compared to socio-demographic

characteristics. In the remainder of this section we derive from existing literature why the explanatory factors in our model are expected to influence labor mobility of university graduates.

- *Regional attributes of the university region*

It is often argued that labor market mobility of graduates is likely to be affected by the attributes of the university region. Previous studies on net flows of graduates across university regions indicate that metropolitan university regions typically attract a larger share of university alumni. In the case of the UK Hoare and Corver (2010) provide evidence that a large share of graduates remain are employed in the London area. In fact, the latter study shows that London is the only area that gains a surplus of university labor, Yorkshire – containing Leeds and Sheffield – has a balanced in- and outflow of university graduates whereas rural areas record a deficit of graduate employment relative to graduate education. Tracking labor market mobility of Pittsburgh graduates Hansen et al. (2003) indicate that the Pittsburgh area is losing a disproportionate number of graduates, mostly to neighboring states. Empirical analysis in the aforementioned study by Hansen et al. (2003) suggests that an improvement in the overall performance of the regional economy, indicated by availability of jobs, reduces the likelihood that graduates leave. Moreover, in a sample of economists with doctoral degrees in the US, Davis and Patterson (2000) find that nearly two thirds of graduates leave their university regions in order to work for their first employer after receiving their doctorate. As this results is stable over time the latter study concludes that some areas (as Washington D.C. in the case of the economists) are responsible for educating a relatively large share of graduates needed on the national labor market while other regions benefit from the "import" of an educated workforce needed for the local demand (as the Southern states in the US in the case of economists). Moreover, the regional importance is also stressed by a recent study of Dutch graduates (Venhorst et al. 2010), which finds evidence that higher unemployment rates of highly educated stimulates migration from peripheral university regions.

While providing evidence that regional factors, as employment and labor demand, matter previous studies also acknowledge that there is mixed evidence on the relevance of regional factors. Analyzing college-labor mobility across states in the US Kodrzycki (2001) finds that six of the ten states with the highest employment growth have the lowest out-migration rates. This finding is in line with the aforementioned argumentation. Yet, the same study also finds that the unemployment rate is not significantly related to cross-state migration rates. This finding suggests that it is difficult to predict cross-state mobility, possibly because of great state sizes and the high variance in state size. Yet,, in view of the above viewed literature, we did include regional characteristics of the university region, denoted by R_i, as an indicator of *regional* labor mobility.

- *Socio-demographic characteristics*

Apart from regional characteristics the decision where to work is likely to be also driven by personal preference, so that idiosyncratic personal characteristics may significantly shape mobility. One important aspect thereby is the general willingness or preference to move across regions. Since individual willingness to move across regions is scarcely included in most data sources from official statistics or graduate surveys, data on former mobility can be used as an alternative. In a large dataset of over 13,000 graduates from over 20 higher education institutes Belfield and Morris (1999) detect that mobility from school to university is highly significantly related to mobility from university to first employment afterwards. However, general willingness to be mobile needs to be distinguished from graduates returning to their original home region.

Moreover, in addition to previous mobility gender may also be a factor indicating the likelihood that graduates leave their university region. In a large dataset of over 380,000 UK graduates Faggian et al. (2007) show that migratory behavior is especially pronounced among female graduates irrespective of whether previous mobility is included as a control variable indicating that female graduates are more likely to search a job elsewhere.

Previous evidence indicates social ties (family, friends) deter mobility. Dahl and Sorenson (2010) show for Denmark that location decisions of scientists and engineers depend to a larger degree on social factors – as close proximity to friends and relatives – and to a lesser degree on regional wage levels. Similarly, Hansen et al. (2003) find in their sample of Pittsburgh graduates that family closeness is significantly positively related to staying in the region when entering employment. In line with the latter two studies Cherry and Tsournos (2001) argue that labor mobility may be especially low in the presence of children. If individuals have children they aim to stay within a region in order to avoid having long distance to their children or forcing their children to adapt to new environments. In the case of Bavarian graduates Falk and Kratz (2009) find evidence that parenthood reduces mobility significantly for female graduates.

Thus, we expect that socio-demographic factors of individuals i (D_i) may affect labor mobility of graduates. Thereby we also account for the possibility that such socio-demographic characteristics may be related to the employability of graduates (E_i) as it is a stylized fact that idiosyncratic factors as age or gender may affect employment chances of individuals (e.g.; Oaxaca and Ransom, 1994).

- *Field of study and study success*

Field of study and study success are likely to impact both graduates employability and their labor mobility. This may be the case for two reasons. First, mobility of graduates may be especially pronounced in certain fields of study. While lawyers and medical doctors need to rely on a strong customer base, especially when being self-employed, it is likely that graduates from these fields are relatively less mobile. On the contrary it is essential for graduates in linguistics or social sciences to be relatively mobile as life experience in different countries or regions may complement the knowledge gained in their subject.

Second, subject studies may have a significant impact on the labor market prospects of graduates. Based on full cohorts of university leavers in UK from 1991 to 1993, Smith et al. (2000) find that the field of study significantly influences the employability of graduates.

Graduates in engineering and medical sciences and engineering are significantly less likely to be unemployed while alumni in humanities are more likely to be incapable of finding a job within six months after graduation. Later studies strengthened this result by Smith et al. (2000). In the case of the UK McGuiness finds that graduates from medical sciences have relatively higher wages compared to graduates from other fields while alumni from humanities and arts earn less. In a representative sample of Italian university graduates of 2001 Buannano and Pozzoli (2009) find that graduates from engineering and natural sciences have the highest employment rate, the shortest average time span from graduation to starting the first job thereafter and the highest hourly wages. Similarly, in Germany it is currently highlighted by both policymakers and economic scholars that the national labor market has a strong demand for engineers, natural scientists and computer scientists (see e.g. Statistisches Bundesamt, 2010; Renn et al., 2009) while there is an oversupply of social science graduates relative to job demand.

Thus, in sum it is commonly asserted that alumni from technical faculty have better job prospects than fellow students in other subjects. Such higher employability must be taken into account when studying mobility as mobility is only detected among those who are employed. Therefore, we expect that in addition to attributes of university region j (R_i) subject studied as well as the study success also influence the labor mobility of graduates. In view of the above derived rationale we assume that study specificities of graduate i (S_i) may have both direct impact on the mobility of graduates and an indirect impact on mobility by shaping the employability (E_i). Consequently, we assume that the employability also has an impact on the mobility of graduates.

3   Data and Empirical Approach

3.1 Data

Our analysis of graduate labor mobility relies on a large-scale data collection of labor market performance of German graduates, namely the German graduate survey KOAB (Kooperationsprojekt Absolventenstudien). The implementation of the KOAB survey is a joint

research project of the *International Centre for Higher Education Research (INCHER-Kassel)* located at the University of Kassel and various higher education institutions in Germany – including both universities and universities of applied science ("Fachhochschulen"). INCHER-Kassel was responsible for survey design and coordination. The universities conducted the survey with graduates from their institution. In doing so, a common core questionnaire was used, however, some optional questions were given that were not used by all institutions.

The present study relies on data of graduates who finished their studies in 2007. Survey implementation was conducted in winter 2008/09, such that the survey was performed 12-24 months after graduates. In total, the survey had a target population of 75.000 graduates, representing 27% of all graduates in Germany in the year 2007. From the total target population 36.100 graduates answered the questionnaire, either online or by postal service, denoting a response rate of 48%. Yet, our analysis is reduced to 11085 graduates. The main reduction stems from the use of optional questions. As some universities did not ask questions on mobility within study time and whether graduates have children these cases are excluded from the analysis such that our analysis relies on information from 36 universities. We acknowledge that this reduction limits our analysis.[1] On the contrary, one advantage of graduate surveys, apart from detailed information about study programs, is the comprehensive data on the employment situation including information on atypical occupation that is often missing in German official labour market statistics (e.g. selfemployed or part-time employment). Further, the data captures individual characteristics of graduates that allow us to analyze the model presented in section 2. In doing so, we focus on graduates with a regular job. Thus, we excluded graduates who are involved in teaching or jurisdictial traineeships as well as further studies since these graduates still qualify for higher degrees and are not available for the labor market, yet.

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[1] Further, we acknowledge that the survey does not include universities from some selected regions, as three German states ("Bundeslaender") conduct their own regional graduate surveys (Bavaria, Rheinland-Pfalz and Saxony). Yet, despite these limitations the KOAB graduate survey provides the largest sample of German graduates with representative samples on the institutional level.

Moreover, we combine this individual data of the KOAB-survey with official data of regional characteristics, provided by the German *Federal Institute for Research on Building, Urban Affairs and Spatial Development* (BBR, 2007). This institution provides particular data of regional development in economic activity, urban development and demographic compostion of German planning regions (NUTS-2 regions). We used the data of 2007 on the scale of planning regions. Thus, we use regional indicators for year of graduation as explanatory variables for regional labor mobility.

3.2 Variables of interest

An overview on all variables is given in table 1. This table comprises information of individual characteristics and study specificities of graduates.

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Insert Table 1 about here

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- *Dependent variables: Mobility and Employability*

As dependent variables we apply regional labor mobility from the location of the university to the place of employment. We use a binary variable indicating whether graduates left the university region – based upon the concept of the German planning regions (*'Raumordnungsregionen'*). Though we do not intend to explain cross-state mobility in our regression approach, we provide also descriptive evidence on the share of graduates who move to another state when starting their first occupation after graduation. Furthermore, as our model also captures employability as an indicator for mobility we apply a further binary variable indicating whether or not a graduate has been employed at all after graduation.

If we take the first measure of mobility, planning regions, 58 % of respondents indicate that they left the region of their university. On the level of states, 34 % were mobile after graduation (see table 2).

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Insert Table 2 about here

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- *Covariates: Regional attributes*

As dependent variables we apply regional attributes of the university region including:

- type of regional settlement structure
- rate of highly skilled employees,
- wage level,

The distribution of mobility by this typification is illustrated in figure 1, showing a wide range of mobility: 36 % mobile graduates if the university is located at a metropolis compared to 77 % if the university is in a rural area.

Figure 2: Regional mobility by type of settlement structure
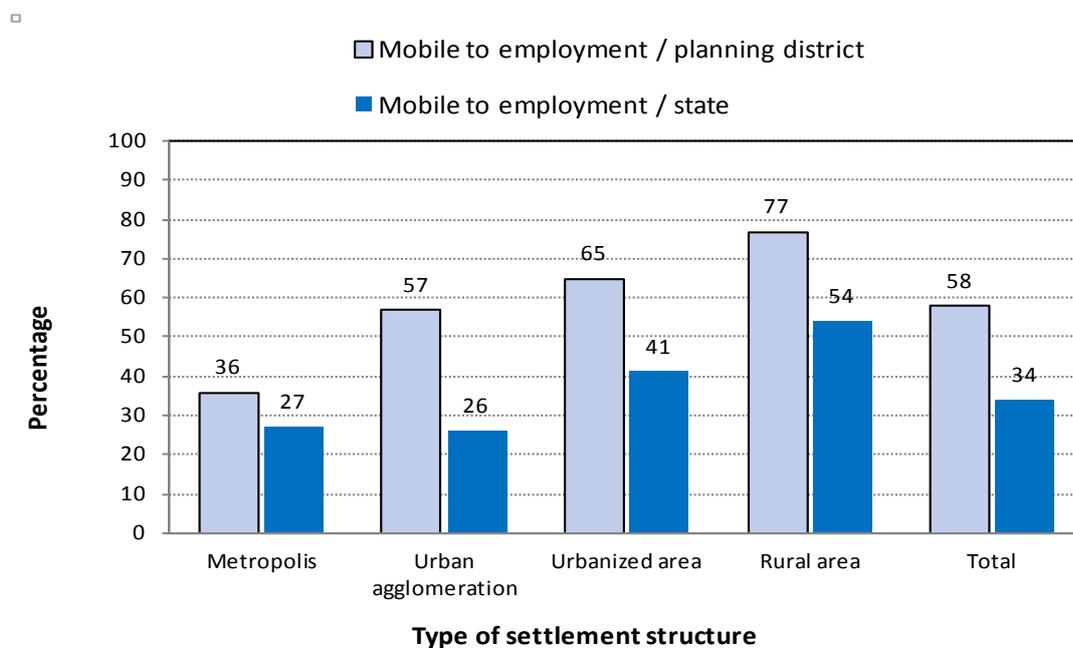
Wage level and unemployment are used in many studies on the interrelation of regional characteristics and labor mobility because they can be seen as basic labor market indicators. Low unemployment rates suggest a high demand for employees and an easy access to the labor market, a high local wage level might enhance the likeliness for labor mobility (for Germany e.g. Buch et al. 2010; Arntz 2009; Hacket 2009). Urban agglomerations have an outstanding importance as a labor market for academics because they offer a highly differentiated labor market matching the specialized skills of university graduates, apart their

simply great size. Some studies use population density to account for agglomeration effects; we use the more complex typology of regional settlement structure of the BBR that combines size, population density and central functions.

- *Covariates: Socio-demographic characteristics*

We include gender and parenthood as social-demographic variables with gender showing no significant disparity for mobility but, as assumed, a lower likeliness of mobility for respondents with children (48 %). Vocational training is included to account for its impact on employment situation rather than on the likeliness of mobility. Former experience with mobility is considered by two variables: a change of region between high school graduation and university and international mobility during the study program. 68 % of respondents were already mobile at the beginning of their study program. Experience with international mobility is indicated by 38 % of the graduates.

- *Covariates: Study characteristics*

Further we apply measures for subject studied, study success and the type of higher ecucation institution. We distinguish between 12 different fields of study. The distribution can be seen in detail in table 1. If we compare the degree of mobility simply by field of study, we find a range from 77 % mobile graduates in agriculture-, forestry- and nutrition science down to 39 % in law or 42 % in natural science, measured as mobility on the level of planning regions (see table 2). In the following descriptive part, only mobility on the level of the planning region is indicated. Figures for mobility between states can be seen in table 2).

In order to measure study success we apply three measures: the final grade ranging from 1.0 to 4.0 (1.0 denoting "excellent" while 4.0 denotes "still sufficient"), length of study, measured in number of semesters studied and the degree a graduate received (bachelor or master degree). Length of study is also used as indicator of study success, as it is widely presumed that a short study length is honored by employers. As can be seen in table 1, graduates with a bachelor degree seem to be more mobile than other graduates (68 % bachelor, 57 % master/diploma).

The type of higher education institution distinguishes between universities and universities of applied science (*'Fachhochschulen'),* because the German universities of applied science have an image of being mainly 'regional' universities, having a local catchment area and providing graduates for the local labour market. The data of the KOAB survey does not support this image, as table 1 shows a higher mobility rate for graduates of universities of applied science (67 %).

3.3 Empirical approach

The mobility of graduates when entering the labor market can only be observed when graduates are employed – since labor mobility of unemployed cannot be stated. In order to account for potential biases resulting from potential self-selection mechanisms we follow Heckman (1979) and apply a two-stage selection model. In a first step, we analyze graduates employability as dependent on their personal characteristics, study specificities and regional characteristics. As our dependent variable is binary we apply probit regression techniques.

Based on these regressions we calculate the inverse Mills' ratio and use it as an explanatory variable for the probability of being mobile. In doing so, we correct for the bias resulting from the selection process into employed graduates when applying the second step of analysis. This second stage is used to analyze determinants of graduates' regional mobility when entering employment. Within this second step of analysis we examine whether or not graduates leave the planning region (Raumordnungsregion) their university region is located in. As our mobility indicator is also binary, we again make use of probit regressions, which allows us to implement the inverse Mills' ratio as an explanatory variable. Thus, our estimation approach is a two-stage heckman selection model applying probit regressions in both stages.

4   Results: Determinants of graduate labor mobility

Following our model of graduate mobility derived in section 2.2 we first analyze the employability of graduate students and relate such employability to idiosyncratic characteristics, field of study and regional attributes of their university region. Results of the probit estimations of employability according to such characteristics can be seen in table 3. Column (1) represents the coefficients of the probit estimation while column (2) denotes the marginal effects. Regarding regional characteristics affecting employability we included settlement structure of the university and tested whether employability is significantly different in rural or peripheral regions – compared to the reference group of agglomeration and urbanized regions. Further, we included the share of highly qualified employers in the region, share of employers in R&D in the region, unemployment rate, wage level and regional gross value. Furthermore, the regression model provides clustered estimates for the 36 different universities in order to account for potential biases, i.e. resulting from specificities of the different higher education institution.

With respect to personal attributes we included gender, age, the information whether or not graduates have children and vocational training. Further, we included the degree – bachelor or master – the final grade, the length of study and the information whether or not a graduate finished at a university of applied science. Moreover, we controlled for field of study.

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Insert Table 3 about here

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From this table it can be seen that regional factors hardly matter. Yet, graduates are less likely to be employed when having graduated in a metropolitan area. With respect to personal attributes it is noteworthy that female graduates are less likely to find a job within the 1-2 years after graduation. Moreover, alumni are significantly less likely to find a job when having children. The latter finding may be caused by less effort to find a job. However,

as we excluded graduates who are on parental leave only graduates who are available for the job market are included. Thus, the negative effect may be caused by disadvantages of graduates with children on the labor market or less effort to find a job, e.g. by restricting the spatial area where to apply for a job. Furthermore, the degree of students matters as bachelors are significantly less likely to find a job. All the mentioned effects are significant on the 1%-level. Moreover, though not reported here, field of study is an important indicator for the likelihood to be employed. While i.e. engineering students are significantly more likely to find a job compared to the overall sample, art and music students are less likely to find a job.[2]

In table 4 our second stage analysis of mobility across planning regions is reported. Thereby, the first two columns report the coefficients (column (1)) and the marginal effects (column (2)) of a model which only capture regional characteristics of the university region. Columns (3) and (4) show, respectively, the coefficients and marginal effects of an extended model which also includes our measures related to personal attributes, field of study and study success As regional explanatory for our model we include settlement structure of the university region, share of highly qualified and R&D employees in a region as well as wage level. These variables reflect the attractiveness of being employed in the region for highly qualified graduates. Unemployment rate and regional gross value, which are included in the employability models, but are not included in our mobility equation as these factors can hardly influence mobility in the subset of graduates who did find a regular employment. With respect to personal characteristics we include the same attributes that are also used in the employability model. Furthermore, we also included the information of being self-employed as well as the two mobility indicators in the analysis. Further, we also controlled for the field of study in the analysis.

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[2] Results fort the relevance of field of study are available upon request from the authors.

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Insert Table 4 about here

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The results indicate that the inverse Mills ratio is significant across all models indicating that our assumption that employability indicators also affect mobility cannot be rejected. Furthermore, it is noteworthy that self-employed individuals are significantly less likely to leave the university region. Furthermore, though not reported here, the field of study has a strong impact on graduate mobility Engineering students are significantly less likely to leave the university region while economic and business students are the most mobile group of graduates.

Regional characteristics of the university region appear to have a significant impact on graduate mobility. Graduates in rural and urbanized areas are significantly more mobile than graduates from metropolises. Moreover, graduates aresignificantly less mobile when they completed their studies in regions with a relatively large share of highly qualified employees in the workforce. Somewhat surprising is the small, but significant and negative effect of R&D employment on mobility. This result suggests that graduates tend to take jobs in different regions when universities and public research play a strong role within their university region. The effect of wage levels in the university region is statistically is also significant, which strengthens our result that regional labor prospects influence the likelihood to leave the region.

5 Discussion and Conclusion

We draw three main interpretations from our results. First, people tend to stay in their home region – if they have the opportunity to do so. Good grades, good regional labor market prospects and a master degree lead, respectively, to a higher likelihood of staying in the region. Further, self-employed graduates have a significantly higher likelihood to work in their

university region compared to the overall population of graduates. On the contrary, when having studied in a peripheral region, relatively bad grades and having graduated from a university of applied science, which is academically ranked lower than traditional universities, leads to a higher likelihood of leaving the region. These findings lead to our interpretation that most graduates tend to stay in their university region, where they have a social network. Yet, some graduates may have *taste for mobility*. Graduates who went abroad during their studies and graduates who moved from school to study are significantly more mobile. Thus, personal attributes shape mobility to a great extent.

Second, regional factors of university regions do also influence the mobility of graduates significantly. Students who did find a job subsequent to studying are less likely to leave when living in a metropolis and when the share of highly qualified employees in the region is relatively high. These findings suggest that the absorptive capacity of regions is crucial for regions to keep their university graduates. Furthermore, qualified people are more likely to stay in metropolises which might indicate that the cultural diversity and variety of free-time activities attracts graduates in the spirit of Florida (2003). However, this finding may also stem from the artifact that metropolis is highly correlated with the share of highly qualified employees, pointing to the possibility that regional labor markets may be the underlying factor explaining the attractiveness of metropolis regions (e.g. Storper and Scott, 2009). In spite of our interpretation that graduates tend to stay in their university region labor market pressure also induces a substantial share of graduates leaves the university region. In total, we find that 58% of graduates leave the university region, while 34% percent of graduates leave the state. This leads to our third interpretation that, indeed, labor market mobility of graduates is a crucial aspect of location planning of higher education institutions. Having one third of graduates leave the state when entering the labor market, it seems of vital importance to undertake an investigation of regional "returns to investments in higher education". However, as this analysis would demand an investigation of state spending in

higher education in relation to all employed graduates, this analysis is beyond the scope and capacity of this study. We, therefore, encourage future analysis in this direction.

Our analysis has important implications for regional higher education policy. As our results indicate that mobility is influenced by both regional labor market characteristics and field of study it seems to be possible to absorb the graduates that are relevant for the regional labor market. Our results indicate that locating universities in peripheral regions should be accompanied by simultaneous efforts to attract private firms and to advocate the local economy in order to strengthen the interaction of university and industry and, thus, extract economic benefits from higher education institutions. Moreover, our results indicate that the competition for the highly qualified already begins with the entry at universities. As good graduates tend to stay in the region it seems beneficial to attract freshman at the first year of studying.

Methodologically, the present study utilizes a two-stage model when analyzing labor mobility patterns. Though we acknowledge that this two-stage model and its empirical implementation are not new, we nevertheless recommend this approach for future analysis of mobility patterns. Our analysis yields that employability of students is significantly related to mobility and, thus, employability may moderate mobility patterns. We, therefore, argue that more studies should follow our direction. Moreover, the question to what extent mediation effects may be observed is an interesting alley for future research.

Finally, we acknowledge that is somewhat limited. We only observe graduates from Germany and do not include any other countries in our sample. Moreover, it is a cross-section of graduates from 2007. Therefore, we encourage future studies in other countries that shed more light on the relevance of regional in social factors as explanatory factors of mobility – either directly related to mobility or mediated by employability.

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Appendix

Table 1: Overview on variables used from the KOAB survey

Variable	Mean	Std.Dev.	Min	Max
Mobility (n = 10333)				
Mobile to employment (by planning district)	0.58	0.494	0	1
Mobile to employment (by state)	0.34	0.474	0	1
Former mobility experience (n = 11085)				
Mobility prior to study (1=yes, 0=no)	0.68	0.468	0	1
International mobility during study (1=yes, 0=no)	0.38	0.486	0	1
Field of Study (n = 11085)				
Languages and cultural Studies	0.21	0.404	0	1
Social science	0.10	0.298	0	1
Law	0.02	0.143	0	1
Economics	0.20	0.398	0	1
Mathematics and computer science	0.10	0.298	0	1
Natural science	0.08	0.268	0	1
Medicine	0.08	0.274	0	1
Agriculture, forestry, nutrition science	0.02	0.148	0	1
Engineering	0.11	0.317	0	1
Architecture	0.03	0.165	0	1
Arts, music	0.02	0.126	0	1
Other field of study	0.04	0.196	0	1
Other study characteristics (n = 11085)				
Bachelor degree	0.06	0.237	0	1
Diploma or master degree	0.94	0.240	0	1
University of applied science *(Fachhochschule)*	0.11	0.317	0	1
Final grade of university degree	1.56	0.627	1	4
Length of study (number of semester)	10.83	3.598	0	80
Demographics (n = 11085)				
Gender (1=female)	0.52	0.499	0	1
Age (years)	27.98	3.833	20	64
Children (1=yes, 0=no)	0.10	0.303	0	1
Vocational training prior to study (1=yes, 0=no)	0.24	0.433	0	1
Self-employed (1=yes, 0=no)	0.07	0.262	0	1

Table 2 Regional mobility by (some) covariates and by measurement level of mobility

	Mobility to employment (mean)	
	by planning district	**by state**
Covariates: Former mobility experience		
Mobile prior to study (n=6992)	0.65	0.39
International mobile during study (n=3946)	0.63	0.55
Covariates: Study characteristics		
Languages and cultural studies (n=2029)	0.54	0.31
Social science (n=994)	0.52	0.33
Law (n=180)	0.39	0.24
Economics (n=2118)	0.68	0.38
Mathematics and computer science (n=1058)	0.54	0.32
Natural science (n=768)	0.42	0.29
Medicine (n=864)	0.65	0.35
Agriculture, forestry, nutrition science (n=226)	0.77	0.56
Engineering (n=1232)	0.56	0.34
Architecture (n=287)	0.66	0.37
Arts, music (n=158)	0.52	0.39
Other field of study (n=419)	0.64	0.34
Bachelor degree (n=547)	0.68	0.33
Diploma or master degree (n=9769)	0.57	0.34
University of applied science *(Fachhochschule)* (n=1259)	0.67	0.41
Covariates: Demographics		
Female (n=5263)	0.59	0.35
Male (n=5070)	0.57	0.33
With Children (n=982)	0.48	0.27
With vocational training prior to study (n=2600)	0.58	0.32
Selfemployed (n=804)	0.45	0.26
Covariates: Regional attributes		
University in metropolis (n=1658)	0.36	0.27
University in urban agglomeration (n=3810)	0.57	0.26
University in urbanized area (n=4850)	0.65	0.41
University in rural area (n=481)	0.77	0.54
TOTAL (n=10333)	*0.58*	*0.34*

Table 3: Employability of university graduates

Variables	**1** (Coefficients)	**2** (Marginal effects)
Regional attributes and ind. mobility		
Universitiy in metropolis	-0.695***	-0.099***
	(0.098)	(0.019)
Peripheral university region	0.156	0.014
	(0.128)	(0.010)
University in agglomeration or urbanized region	(Reference)	(Reference)
Share of highly qual. employers in region	0.004	0.000
	(0.027)	(0.003)
Employers in R&D in region	-0.008**	-0.001**
	(0.004)	(0.000)
Wage level of employers	0.000	0.000
	(0.000)	(0.000)
Unemployment rate	-0.001	-0.000
	(0.008)	(0.001)
Regional gross value	0.025***	0.002***
	(0.007)	(0.001)
Individual Characteristics		
Gender (1=female)	-0.185***	-0.018***
	(0.044)	(0.004)
Age	0.005	0.001
	(0.006)	(0.001)
Children (1=yes, 0=no)	-0.525***	-0.072***
	(0.060)	(0.011)
Vocational training (1=yes, 0=no)	0.012	0.001
	(0.055)	(0.005)
Mobility from school to study	0.052	0.005
	(0.043)	(0.004)
International mobility during studies	-0.025	-0.002
	(0.043)	(0.004)
Study specifities		
Degree (1=bachelor)	-0.683***	-0.108***
	(0.070)	(0.016)
Final grade of university degree	-0.076**	-0.007**
	(0.033)	(0.003)
Length of study	0.004	0.000
	(0.006)	(0.001)
University of applied science	0.296***	0.024***
	(0.092)	(0.006)
Constant	-0.021	
	(0.488)	
Field of study controls	YES	YES
Observations	11085	
Mac Fadden's R2	0.165	
Log-likelihood	-2380.6373	
Wald test	X2(28)	
	737.20***	

Notes: Standard errors in given in parentheses. The asterisks denote to following significance-levels:
*** significant at 1%, **significant at 5%, * significant at 10%

Table 4: Regional labor mobility of university graduates

Variables	Models (1) Coeff.	(2) Marg. Eff	(3) Coeff.	(4) Marg.Eff.
Regional characteristics of university region				
Peripheral university region	0.661***	0.228***	0.561***	0.198***
	(0.097)	(0.028)	(0.118)	(0.036)
Urban university region	0.317***	0.123***	0.250***	0.097***
	(0.069)	(0.026)	(0.087)	(0.033)
Agglomeration region	0.243***	0.094***	0.161**	0.062**
	(0.060)	(0.023)	(0.078)	(0.030)
Metropolis	(Reference)	(Reference)	(Reference)	(Reference)
Wage level	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)
Share of highly qualified in	-0.101***	-0.040***	-0.094***	-0.037***
	(0.015)	(0.006)	(0.015)	(0.006)
Share of R&D employees	0.012***	0.005***	0.010***	0.004***
	(0.002)	(0.001)	(0.002)	(0.001)
Individual characteristics and study specificities				
Female			0.061**	0.024**
			(0.031)	(0.012)
Children			-0.133**	-0.052**
			(0.058)	(0.023)
Self-employed			-0.258***	-0.102***
			(0.050)	(0.020)
Degree (1=bachelor)r			0.313***	0.117***
			(0.089)	(0.031)
Length of study			-0.015***	-0.006***
			(0.004)	(0.002)
Final grade of university degree			0.062***	0.024***
			(0.023)	(0.009)
University of applied sciences			-0.002	-0.001
			(0.050)	(0.020)
Mobility school to university			0.545***	0.213***
			(0.028)	(0.011)
Mobility during studies			0.191***	0.074***
			(0.028)	(0.011)
Inverse Mill's Ratio	-0.557***	-0.217***	-0.831***	-0.324***
	(0.189)	(0.074)	(0.333)	(0.130)*
Constant	1.206***		0.880**	
	(0.271)		(0.347)	
Field of Study Controls	YES	YES	YES	YES
Observations	10333		10333	
Cragg-Uhler R2	0.108		0.174	
Log likelihhood	-6602.2593		-6315.5611	
Wald Test	X2(18)		X2(27)	
	861.54***		1434.93***	

Notes: Standard errors in given in parentheses. The asterisks denote to following significance-levels: *** significant at 1%, **significant at 5%, * significant at 10%