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## New Region, New Chances: Does Moving Regionally for University Shape Later Job Mobility?

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# New Region, New Chances: Does Moving Regionally for University Shape Later Job Mobility?

## Abstract

The extensive literature on university graduates' regional mobility highlights the importance of early mobility but is primarily descriptive. We contribute the identification of the effect of mobility upon high-school graduation on subsequent mobility across labour market regions. The data permit a novel identification strategy that uses the distance to university as an instrument. To ensure comparability, we select high-school graduates from only the suburban region of a large German agglomeration in a university graduate survey. We find that early mobility leads to a sizable increase in later labour mobility, which has implications for labour market efficiency and distributional policy concerns.

JEL-Codes: J610, R230, I230.

Keywords: regional mobility, job mobility, distance to university, students, spatial, instrumental variables estimation.

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# 1 Introduction

The effectiveness of many policies depends on labour mobility. In particular, place-based policies often rely on the availability of high-skilled workers (Ehrlich and Overman, 2020), such that increasing workers' mobility can be an important complementary measure. Hence, it is crucial to understand the determinants of labour mobility. While the literature has found that early mobility is strongly associated with later mobility (e.g. Faggian et al., 2007 and Haussen and Uebelmesser, 2018), it is unclear whether policies increasing early mobility would result in higher mobility later on. In this investigation, we use a novel instrumental variable approach to illuminate this relationship and quantify the effect.

Improved match quality between workers and jobs after graduation might explain a mobility wage premium for students found by, e.g., Di Cintio and Grassi (2013). Wages and skills are strongly influenced by where people grow up and where they work (e.g. Mion and Naticchioni, 2009; Combes et al., 2012 & Bosquet and Overman, 2019). A central point in the investigation of labour mobility outcomes is therefore the selection on unobserved characteristics. In general, controlling for the motivation to move is difficult if not impossible. When it comes to student mobility, parents' willingness (or ability) to pay the rent of their child who attends university in another city is not observed. Moreover, whether an individual decides to move to study is at least partly predetermined by her environment, her family background, and the area she lives in. Therefore, research that considers mobility as an explanatory variable must carefully address aspects of reverse causality and selection into treatment.

We investigate how regional mobility for the first job is affected by a previous moving experience. We examine the regional migration for university of high-school graduates, i.e. their decision to enrol at a university nearby or in another labour market region (LMR), and how this decision to move affects mobility upon university graduation. The decision in which region to enter the labour market is likely to be consequential for university graduates' career paths and lifetime earnings. Thus, through its effect on subsequent moves, mobility upon high-school graduation can have long-term consequences for a region's social and economic development that go far beyond students' spending (Carrascal Incera et al., 2022).

We apply an instrumental variable strategy to account for omitted variable bias and reverse causality in the endogenous movements after high-school graduation. The distance to university is used as an instrument for the decision to study in the home LMR or another LMR. However, there is still the issue of selection, which is determined by a high-school graduate's place of residence. Therefore, we focus on university graduates who went to high school in the suburbs of Munich, the capital of the federal state of Bavaria and the third-largest city in Germany. We define the suburbs as the region around Munich where commuting

relies on suburban trains. We, therefore, define a “doughnut” with an inner radius of 15 km (around 5 km from the metro network) and an outer radius of 30 km (still around 10 km within the suburban train network). Thus, we exploit variation in distance within a narrow window ensuring comparability of moving and staying high-school graduates. Additionally, we control for parental characteristics. We use two waves of a survey with detailed information on the places of residence (down to postcode-level) of university graduates from 2005/06 and 2009/10 in Bavaria, from high school through university until about roughly 1.5 years after university graduation.

Migration tends to take place from rural areas to larger agglomerations. In Germany, however, economic activity is more decentralised than in other countries. So-called “hidden champions”, firms with significant market share, located in more rural regions, represent a significant part of the economy. Since German workers are generally less mobile by international standards and high-skilled workers are also in demand outside agglomerations, students’ mobility and ensuring that university graduates also move from metropolitan areas to smaller communities is especially important in Germany.

We find that the further a high school is located from a university, the more likely are its graduates to move to study in another LMR. Note that in the first stage, we exploit only small changes in the distance to university. Subsequently, the decision to enrol at another university increases the likelihood of moving again to a third LMR for the first job after graduation. We show that the labour mobility of high-skilled workers is shaped by a relatively early mobility decision and small initial differences can have large effects later on.

The plausibility of the exclusion restriction is supported by descriptive evidence: the instrument is not correlated with the control variables. For instance, the average grade in each high school is not correlated with the instrument. Hence, graduates located further away from a university show similar abilities compared to graduates closer to a university. Moreover, the results are robust to the selection of the area we investigate and a variety of control variables, highlighting only two important robustness checks.

In contrast to the related literature on college proximity, which goes back to Card (1993), we focus on a suburban region in which we exploit relatively small differences in distance to university. Our treatment distance lies within 15 km, which represents a finer spatial variation compared to related studies (e.g. Kjellström and Regnér, 1999; Kling, 2001 & Frenette, 2006). Additionally, we apply this approach to regional labour mobility. We add to the literature by investigating the effects of migration originating in an agglomeration from which high-school graduates move to other universities in the same state.

We structure our paper as follows. In Section 2, we discuss the related literature. In Section 3, we provide relevant background information on the educational system in Germany. Section 4 presents the methodology we apply to estimate the extent of induced mobility and

the way we deal with potential endogeneity issues. In Section 5, we describe the graduate survey we use for our investigation. In Section 6, results are discussed and we present robustness checks to validate our findings. Finally, Section 7 summarises our findings and provides policy implications that can be drawn from our results.

## 2 Related literature

This paper contributes to the literature on labour mobility, and in particular the mobility of students and high-skilled workers, by providing evidence for a sizeable effect of regional mobility after high school on mobility when entering the labour market. While the literature has found this correlation in various countries (e.g. US: Kodrzycki, 2001; UK: Faggian et al., 2007; Italy: Ciriaci, 2014; Germany: Haussen and Uebelmesser, 2018), we add a setting with a relatively homogeneous population of students, allowing us to identify the effect of the first move on mobility upon graduation. We do so by employing a sample for an economically important agglomeration in Europe, allowing us to observe the effects of mobility *away* from this area.

While we study mobility before university enrolment and after university graduation in a specific setting, the well-identified relationship itself is a more important contribution than the specific quantification. The interpretation and policy implications of the relationship between earlier and later mobility found in the literature depend on its nature as much as on its economic size in a specific context. Thus, our study complements earlier insights and lends support to the notion that earlier mobility increases later mobility, rather than a mere correlation with both being determined by other factors such as socio-economic background or an individual's flexibility.

For Germany, research on how to identify the effects of mobility is relatively limited. Krabel and Flöther (2014) use a nation-wide survey among German university graduates and find that higher mobility from school to university is associated with higher mobility when starting the first job. Generally, they find a lower level of mobility for university graduates in metropolitan areas and attractive labour markets. Haussen and Uebelmesser (2018) show that previous inter-regional migration is associated with an increase in university graduates' propensity to move for a job. They estimate Heckman models with survey data covering five years after graduation.

For the US, several studies link labour market mobility to previous mobility. Groen (2004) shows that students studying in one state for college tend to enter the labour market in this state as well. Employing an instrumental variable approach, Malamud and Wozniak (2007) find a higher level of mobility and higher willingness to move longer distances for college graduates than for workers without a college degree. Similar results are found by Kodrzycki

(2001), who evaluates the National Longitudinal Survey of Youth from 1979 to 1996. These findings strengthen our argument to consider only university graduates in our analysis.

Using a survey of entrepreneurs in China, Wu and Eesley (2022) suggest that migrants' risk aversion is lower than non-migrants' risk aversion to begin with, and is further lowered through the migration experience. This is in line with our result that the propensity to move after high school is not just correlated with the propensity to move for the first job, but that the mobility experience actually induces later mobility.

Ballarino et al. (2022) study the determinants of the mobility of Italian high-school graduates for different distances. They suggest that the mobility of university graduates may prevent a longer-term “brain gain” when universities are built to keep high-school graduates in the region. The results of our study support a more optimistic view, as we find that early mobility induces labour mobility, and not only towards the already thriving agglomeration. Hence reducing the need for an early move may help retention. Our results thus complement the factors affecting graduate retention identified in other studies such as Kitagawa et al. (2022), who find that the subjects offered by universities influence the retention of labour as well as entrepreneurship in England.<sup>1</sup>

In terms of the econometric approach, our paper relates to the literature that uses college proximity as an instrument. This strand of literature goes back to Card (1993) who estimates the return to schooling. He measures college proximity by an indicator and finds both more schooling years and higher earnings for those growing up near a college. Interestingly, the unbiased IV estimates are 50 to 60 per cent higher compared to OLS. We add to this literature by focusing on a suburban region, where we exploit differences in distance to university within a narrow window and analyse its effect on regional job mobility.

Many studies employ college proximity as an instrument for college enrolment. Kjellström and Regnér (1999) use Swedish data to investigate the relationship between the distance between the place of residence and the closest university, which can be up to 150 km, and enrolment rates. They find a small but significant negative effect of distance on enrolment rates, controlling for a set of personal and parental characteristics. However, they cannot find any effect for the first 26 km. Taking family background into account, Kling (2001) shows that college proximity has a great impact on the transition from high school to college. Frenette (2004) examines this relation using data from the Canadian Survey of Labour and Income Dynamics and finds a more pronounced effect for individuals from lower-income families. Moreover, Frenette (2006) shows that the likelihood of enrolling at a university decreases significantly when a person's residence is not within an acceptable commuting distance, and that this effect is especially prevalent for people from the lower end of the

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<sup>1</sup> The results of Drejer et al. (2022) suggest that the effects of mobility may differ for employed university graduates and entrepreneurs, as the latter benefit more from the attachment to their home region.



income distribution. Further studies identify parents' education and household income as primary factors influencing the decision to enrol at a tertiary education institution (e.g. Acemoglu and Pischke, 2001 & Shea, 2000). For Germany, Spiess and Wrohlich (2010) show a higher likelihood of attending university if students live in close proximity to a university when they complete secondary education. Unlike the previous studies, a distance of more than 12.5 km to the closest university is defined as "far away" while those individuals who live within a 6 km radius of a university are "closely located".

### 3 Institutional setting

#### 3.1 Tertiary-education system

In the following, the administrative setting of the German tertiary-education system is described, as well as how it might affect high-school graduates' decision to move for university. Most importantly, students in Germany are not regionally bound when applying for university. To enrol at a university, students need a university entrance diploma, which is awarded upon successful completion of high school.<sup>2</sup> This diploma entitles students to enrol at every public university in Germany. However, universities may have local admission restrictions (so-called *Numerus Clausus*, NC), that admit only high-school graduates with a final grade above a particular threshold for a certain field of study. The NC differs between universities. On average, admission in Munich might require better grades. However, high-school grades are not statistically significantly correlated with distance (and their point estimator is negative), such that this should not bias the results.

German public universities are tuition-free and entirely financed by the public. However, in the period we investigate, some states charged fees. If a state charged fees, the fees had to be between 300 and 500 Euros per semester by law and were set by the university.<sup>3</sup> Most universities set their fees to 500, some to 400, and very few to 300 Euros. All Munich universities had a 500-Euros fee. The variation at Bavarian universities was very limited.<sup>4</sup> Some high-school graduates might have gone to another state to avoid paying fees. However, they are not included in the data we analyse. If the main trade-off these graduates have in mind is between commuting and rental costs, higher tuition fees in Munich restrict the graduates' budget and therefore make staying and commuting relatively more expensive. This

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<sup>2</sup> Throughout this paper, the term university is used to refer to both universities and universities of applied sciences. German universities of applied sciences (*Fachhochschule*, FH) are higher education institutions that focus on education that is more closely oriented to job requirements.

<sup>3</sup> [https://www.studis-online.de/hochschulpolitik/art-463-studiengebuehren\\_bayern.php](https://www.studis-online.de/hochschulpolitik/art-463-studiengebuehren_bayern.php), accessed on 06.12.2021.

<sup>4</sup> Additionally, there were a *Studentenwerksbeitrag* which was a lot lower (usually less than 50 Euros) which also differed between cities.

means that someone who is indifferent between commuting a daily distance of  $x$  kilometres in Munich or paying  $y$  Euros for rent in another city might move to that city when considering the lower fees in addition to lower rent. However, the differences in the fees are marginal in comparison to rental costs and should not be relevant for the estimation, especially since they are independent of our instrument (distance to university).

### 3.2 Background on Munich

In our investigation, we focus on the city of Munich, the capital of the German state of Bavaria, and its political and economic centre. The city hosts three public universities, which are amongst the biggest in Germany. Two of them (the University of Munich and the Technical University) are highly ranked in national and international rankings. The universities in Munich are located close to each other and within a distance of 1.5 to 3 km to Marienplatz. All relevant fields of study are covered by these universities. This leads to the conclusion that there are no academic reasons to leave Munich when enrolling at a university.

The metropolitan area of Munich belongs to the wealthiest areas in Germany and is characterised above all by a strong labour market with a high density of well-known firms.<sup>5</sup> This reduces the need to leave Munich when entering the labour market, since Munich has an attractive labour market, especially for high-skilled workers.<sup>6</sup> Hence, even if one chooses the university based on the attractiveness of a city's labour market, the necessity to leave Munich after graduating from high school is low.<sup>7</sup>

Munich has a very good public transport system, especially in terms of travel time from the suburbs to the city centre, where the university facilities are located. Thus, for each individual in our sample, it is possible to commute without a car.

The main reason why people leave Munich is the competitive housing market, which has the highest prices in Germany. This is especially true for shared apartments, which students in Germany often opt for.<sup>8</sup> If a high-school graduate prefers leaving her parents' home when enrolling at a university, it is more affordable to study in another city.

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<sup>5</sup> Examples are corporations like Allianz SE or BMW AG.

<sup>6</sup> For example, Munich is ranked first in the 2021 ranking of German cities by *Wirtschaftswoche*, a business news magazine. See <https://www.wiwo.de/politik/deutschland/staedteranking/>, accessed on 06.12.2021.

<sup>7</sup> This argument is theoretically validated by research of e.g. Weinstein (2018) who shows the positive nexus between reputable universities (such as those in Munich) and so-called "elite firms", which is a paraphrase for preferred employers.

<sup>8</sup> See e.g. <https://www.empirica-institut.de/nc/nachrichten/details/nachricht/empirica-ranking-mieten-fuer-wohngemeinschaften-in-unistaedten-iii2015/>, accessed on 09.09.2020.

## 4 Method

### 4.1 Conceptual framework

High-school graduates might move when entering university because they are intrinsically motivated to experience living in a new place. Moreover, they might need to move if they live in a region without a university or if the subject they are most interested in is not offered at their home university. Other reasons include the attractiveness of a labour market in another region or reasons related to the personal environment and relationships with family and friends. Especially the latter reason could also explain why high-school graduates decide not to move to attend university since social ties are valuable and decay over time.<sup>9</sup> Another reason could be financial restrictions, as it is cheaper to live with one's parents while studying.

The second move, when transitioning from university to the first job, is substantially determined by experiences gained from the decision in the first stage. If a graduate has experienced living in a new place as something positive, she might be willing to move again, knowing that she can easily adapt to a new environment. However, if she has never moved before, she might be more sceptical about getting to know a new region. I.e. without prior mobility experience, university graduates' may suffer from an information deficit about the costs of moving in general, which prevents them from moving for a job irrespective of the particular destination region. Furthermore, students who have moved for university after high school will likely have weaker social ties and place-specific social capital at their university town after their studies compared to those who have gone to university where they have grown up. At the same time, ties to their hometown will have weakened over the years for students who moved to university. Thus a first move can make a later move less costly in terms of sacrificed social capital, adding another reason why early mobility increases later mobility. Distance to university has no direct effect on the decision to move for the first job after university graduation. The decision is only indirectly affected through the first move.

In short, various variables could affect mobility for university as well as mobility for the first job. An anticipated move for the first job might even lead to earlier mobility for university, i.e. reverse causality. Therefore, regressing moving for the first job on moving for university could lead to biased estimates.

To take such endogeneity concerns into account, we use the (road) distance to university as an instrument.<sup>10</sup> To ensure an as-good-as-random allocation of the individuals before their

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<sup>9</sup> The literature often distinguishes strong and weak ties (Granovetter, 1973). A recent study by Becker et al. (2021) finds empirical evidence that a lack of interaction weakens social ties as time passes.

<sup>10</sup> We use the distance to the closest of the three universities in Munich for each individual. Throughout the paper, we refer to it as "distance to university".

first decision to move, we first control for parental characteristics and second, we consider only high-school graduates from Munich's suburban area.

In the first stage, the commuting distance to university is important for the decision to move for university. It is driven by the trade-off between the costs and benefits of moving. While the costs of staying increase with growing distance due to longer commuting times and higher prices for (public) transport, the costs of moving are not affected by distance.<sup>11</sup> Hence, distance to university is a relevant instrument for the decision to move for university.<sup>12</sup>

Next, we argue that distance to university is exogenous. Distance is driven by the place of residence.<sup>13</sup> Parents decide where to settle based on factors such as labour market conditions, proximity to work, relatives or friends, and the availability of affordable housing. Proximity to university is only an issue of minor importance, and likely negligible within county when our sample is limited to 15 to 30 km distance to the city centre.

Another obstacle to an unbiased estimate is that high-school graduates might be influenced by their peripheral environment, for instance, whether it is urban or rural. Therefore, our sample includes a set of comparable students who come from Munich's suburbs. We define the suburban area based on the distance of the high school where a student graduated to the city centre. The centre is defined as the location of the town hall at *Marienplatz*, Munich's central square, where all suburban trains and two of the major metro lines run. The suburban area is defined as a doughnut with an inner radius of 15 km and an outer radius of 30 km. In Munich, the average travel distance between the city centre and the final stop of a suburban train (*S-Bahn*) is 39 km, while this distance is 11 km when taking the metro (*U-Bahn*) instead of the suburban train.<sup>14</sup> By drawing the inner circle at 15 km, we ensure that the considered individuals are far enough away from the final stops of the metro, which to some extent form the city boundaries, such that they have to use additional means of transport. At the same time, setting 30 km as the outer border ensures that all individuals within the circle live in an area with a similar degree of urbanisation. High-school graduates living in the area between 15 and 30 km from the city centre are similarly close to a train station, and therefore, have equally good public transportation connections to the centre and the Munich universities. Additional analyses show that the results are robust to varying the two radii defining the doughnut.

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<sup>11</sup> Very few students own a car for their daily commute.

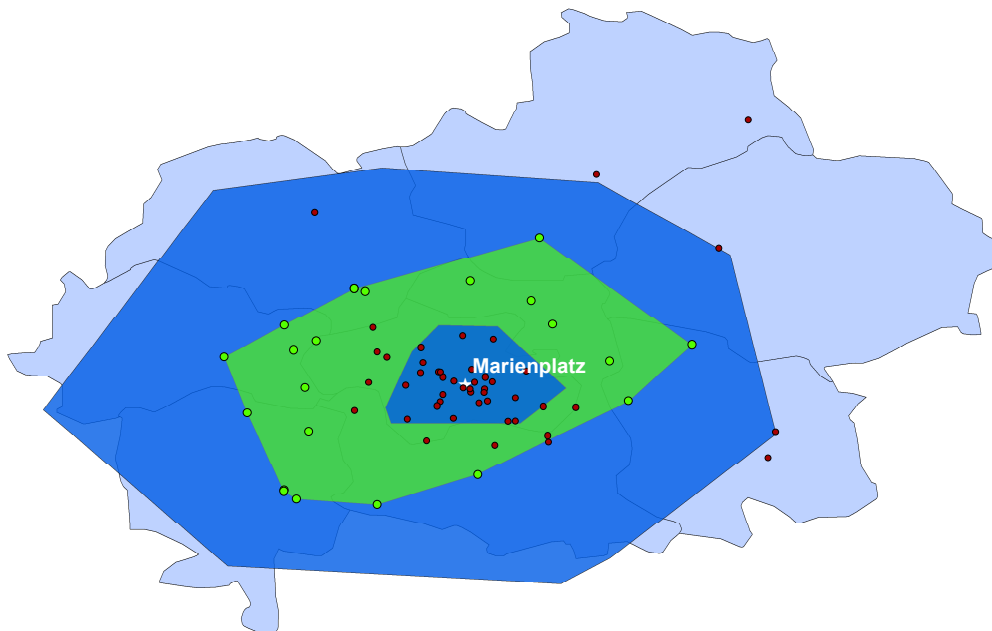
<sup>12</sup> We calculate distances as road distances with *osrmtime* by Huber and Rust (2016) to account for geography and streets, which reflects commuting more realistically.

<sup>13</sup> We do not know the location of the home (town) but only the high school the graduates went to. However, the spatial deviation is likely not in a specific direction and therefore does not bias the distance between home and university.

<sup>14</sup> The distances are the arithmetic mean of the distance between Marienplatz and the final stops of public transport.

Figure 1 illustrates the area of interest for our analysis. The LMR of Munich is shown in the background. The lines reflect the county borders. Each dot represents one high school. Bright (green) dots are part of the doughnut and are therefore included in our sample. The bright (green) area is the convex hull of these high schools and roughly illustrates the doughnut.<sup>15</sup> Dark (red) dots are high schools that are not part of the analysis, either because they are too close to the city centre or too far away from it. The dark (blue) doughnut (outer dark (blue) area) is the convex hull of suburban train stations. The inner dark (blue) area is the convex hull of the metro stations.

Figure 1: Selection of our sample



*Notes:* High schools are represented as dots. Bright (green) dots are part of the doughnut, whereas dark (red) dots are in the inner circle or outside the doughnut. The bright (green) area is the convex hull of the bright (green) schools. The inner dark (blue) area is the convex hull of the metro stations, the outer dark (blue) area is the convex hull of the suburban train stations, and the background represents the shape of the LMR of Munich, with the lines showing the counties within the LMR.

## 4.2 Empirical strategy

We define moves based on the location of the high school, the chosen university, and the first job.<sup>16</sup> We code moving as a change in the LMR. According to the definition of LMRs,

<sup>15</sup> In a convex hull, a line that connects any two dots is always contained.

<sup>16</sup> This is especially true for the first moves, as the survey does not include questions about moving out of the family home after high-school graduation.

commuting times are acceptable within these areas but not between them.<sup>17</sup> We argue that this is true regardless of whether a person commutes to work or university. We code “moved for university” as one if a graduate is not enrolled at a Munich university. Analogously, if the first residence after graduating from university is in an LMR other than the university and not in Munich, we define the graduate as having “moved for job”.<sup>18</sup> Formally, we regress “moved for job” ( $Y_i$ ) on “moved for university” ( $\hat{X}_i$ ) for university graduate  $i$ :

$$Y_i = \beta_0 + \beta_1 \hat{X}_i + \beta_2 \text{parental}_i + \beta_3 Z_i + \beta_4 \text{county}_i + \epsilon_i, \quad (1)$$

where we are interested in  $\beta_1$ . Additionally, we control for parental characteristics ( $\text{parental}_i$ ), further control variables ( $Z_i$ ), and the county in which the university graduates went to high school ( $\text{county}_i$ ).<sup>19</sup> In the base specification, the parental characteristics  $\text{parental}_i$  contain the father’s occupational status.<sup>20</sup> The control variables  $Z_i$  are only considered in robustness checks. The first stage is as follows:

$$X_i = \alpha_0 + \alpha_1 \text{distance}_i + \alpha_2 \text{parental}_i + \alpha_3 Z_i + \alpha_4 \text{county}_i + e_i, \quad (2)$$

<sup>17</sup> The concept of labour market regions (*Arbeitsmarktregion*) was developed by the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR). LMRs are usually sharply defined by the counties (*Kreise*) and federal states (*Bundesländer*) and are defined as regions within which workers commute. More specifically, LMRs are defined as regions in which at least 65 per cent of all wage earners with residence in this region also work in this region and that at least 65 per cent of all paid jobs are filled with domestic workers (stemming from this region). Additionally, commuting times within an LMR should not exceed 45 minutes each way. For more information see [https://www.bbr.bund.de/BBR/EN/Home/\\_node.html](https://www.bbr.bund.de/BBR/EN/Home/_node.html), accessed on 28.09.2020.

<sup>18</sup> More specifically, university graduates returning to the home LMR for the first job are not considered in the main specification and are defined as not having moved for the first job in a robustness check.

<sup>19</sup> The control variables  $Z_i$  contain gender, age, whether the graduate has children, and relationship status. The relationship status can either be without a firm partner, having a firm partner but not living together, or living with a firm partner. Moreover, included in  $Z_i$  are the high-school diploma grade, the main subject (economics, engineering, science, and remaining subjects), whether the university graduates did an internship during their studies, and whether they lived abroad. The subject economics includes business administration, business informatics, industrial engineering, and economics. The subject engineering includes civil and environmental engineering, electrical engineering, information technology, and mechanical engineering/materials. The subject science includes applied natural sciences, biology/biological sciences, chemistry, computer science, mathematics, and physics. The remaining subjects include English/American studies, architecture, education, geography, German studies, legal studies, pharmacy, political science/social sciences, psychology, Romance studies, social work, sports/sports science, and missing subjects.

<sup>20</sup> We control only for the father’s occupational status as it might be the best proxy for family income. We do not include the father’s educational level or the corresponding variables for the mother. We did this to avoid collinearity due to the high correlation between these variables. Results with other specifications are shown as robustness checks. The father’s occupational status contains four categories, which are defined as follows: 1 if unskilled/semi-skilled workers, never been employed or occupation unknown; 2 if scientific employees without management function, qualified employees (e.g. clerks), executive employees (e.g. salesperson, typist), civil servants in the higher service, civil servants in the ordinary/intermediate service or skilled worker with apprenticeship; 3 if self-employed persons in the liberal professions or independent contractors; 4 if executive employees (e.g. department heads, directors), scientifically qualified employees with medium or senior civil servants

where  $distance_i$  stands for the distance to university. The instrumental variable approach uses the predicted values  $\hat{X}_i$  from the first stage (Equation 2) for the independent variable “moved for university” in the second stage (Equation 1).

## 5 Data

### 5.1 Bavarian Graduate Panel

To investigate the decision to move and where to enrol at university as a determinant of early regional job mobility, we use the Bavarian Graduate Panel (*Bayerisches Absolventen Panel*, BGP), a survey amongst graduates from Bavarian universities.<sup>21</sup> The BGP is conducted by the Bavarian State Institute for University Research and Development (*Bayerisches Staatsinstitut für Hochschulforschung und Hochschulplanung*, IHF) and focuses on the transition from university to the labour market. The aim is to cover all Bavarian universities and all fields of study.<sup>22</sup> The survey is conducted approximately every two to three years, with the first cohort interviewed in 2003/04 and the fourth and last surveyed in 2013/14. The paper-based questionnaires are sent by the universities to their respective graduates and are subsequently collected and processed by the IHF.

In the survey, university graduates are asked about their course of study, their first working positions, socio-economic indicators, and when and where they received their university entrance diploma. A distinct feature of the BGP is the possibility to spatially track persons at a granular level since university graduates indicate the postcode of the high school, they graduated from, the name of the university, and the postcode of their first work position.<sup>23</sup> University graduates are interviewed up to three times after graduation. While the first wave takes place roughly 1.5 years after graduation and focuses on the transition from university to the labour market, the second (approximately five years after graduation) and the third (approximately ten years after graduation) waves are more focused on employment history and job training.

We use the first wave of the BGP and concentrate on the two graduation cohorts of 2005/2006 and 2009/2010. We focus our investigation on these two cohorts as they offer the largest overlap of variables. The BGP questionnaires vary considerably between cohorts. For the 2013/14 cohort, there is no detailed information on the high-school location and it is therefore not included in our sample.

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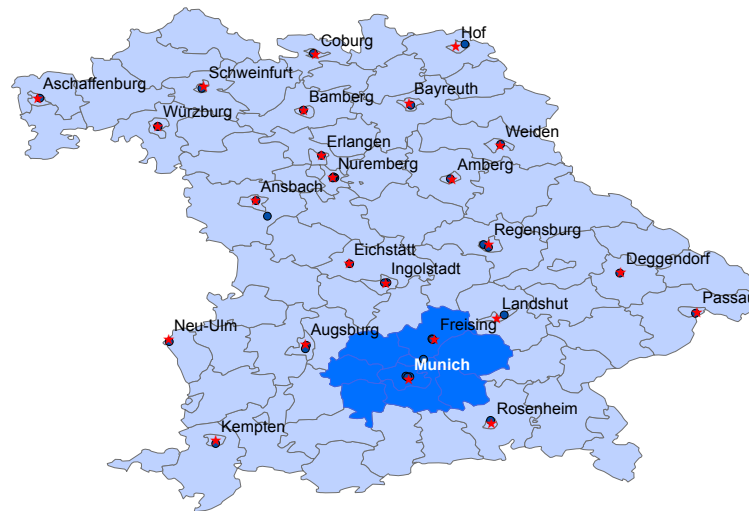
<sup>21</sup> For more information, visit <https://www.bap.ihf.bayern.de/en/bap-home>, accessed on 10.09.2020.

<sup>22</sup> For data protection reasons, a field has to have at least ten graduates in the respective survey year in order to be included.

<sup>23</sup> University graduates do not directly indicate the postcode of their employers' office but the postcode of their home address after starting work.

The location of all universities is shown on a map in Figure 2. This figure illustrates the high density of universities in Bavaria and supports our argument that students have a wide choice of universities in Bavaria.

Figure 2: Overview of all Bavarian cities with a university (of applied sciences)



*Notes:* In this map of Bavaria with county boundaries, all cities with a university (of applied sciences) are named and marked with a star. Each university (of applied sciences) is shown with a dot. The LMR of Munich is highlighted (in dark blue).

As the survey took place at Bavarian universities, we have no information on high-school graduates who went to high school in Bavaria but did not study at a Bavarian university. Hence, we can only analyse mobility patterns of high-school graduates who chose a university in the state in which they went to high school.<sup>24</sup> However, this is not problematic for our identification for two reasons. First, German students are not very mobile between states. Statistics from the Federal Statistical Office (2019) show that roughly 60 per cent of all freshmen in Bavaria also come from Bavaria and that only 20 per cent of all Bavarian high-school graduates who decide to study leave Bavaria to do so.<sup>25</sup> Second, also in the general population more than 85 per cent of all relocations in Germany happen within the same state.<sup>26</sup> Moreover, we have no information on workers without a university degree. Hence, our results are also conditional on graduating from university. Thus, the individuals we analyse are highly skilled and particularly relevant for regional economic development. University graduates also are more mobile than the average labour market participant.

<sup>24</sup> This restriction does not apply to job mobility, however. We observe university graduates from a Bavarian university if they move to another state or even to another country.

<sup>25</sup> This percentage corresponds to the year 2014, the values for other years differ only slightly.

<sup>26</sup> See e.g. <http://www.postadress.de/umzugsstudie.pdf>, accessed on 23.09.2020.



## 5.2 Descriptive statistics

Only 22 per cent of all graduates from a Munich high school in our data leave Munich when they go to university.<sup>27</sup> This is one of the lowest rates compared to other LMRs. Regensburg, which is a small and lively student city, has a similar share. This low level of mobility also applies to the second move when it comes to deciding where to enter the labour market after university graduation: Only 13 per cent of all university graduates from Munich in our data decide to leave Munich for their first job. This is by far the lowest rate. Ingolstadt, known for its car manufacturer Audi, is the LMR with the second-lowest share at 26 per cent. This shows that a majority of high-school graduates from Munich stays in Munich both for university and for their first job. According to our data, about half (58 per cent) of those who leave Munich to study return to enter the labour market. This is by far the highest rate and again demonstrates Munich's strong labour market and residents' attachment to their city.

For our main group of interest, namely, students who come from Munich's suburbs, the cities of Augsburg, Passau, and Regensburg are the most popular destinations for those who move to a new region for university. While Augsburg is still relatively close to Munich (80 km), Passau, at 170 km, and Regensburg, at 125 km, are relatively far away. The locations of the university graduates' first jobs are geographically very widespread and include regions with smaller and larger cities, within Bavaria but also in other parts of Germany or abroad.

From 4,387 (9,455) surveyed university graduates in 2005/06 (2009/10), 795 (1,844) went to a high school within the Munich LMR. Thus, there are 2,639 surveyed individuals in the Munich LMR when pooling both survey waves. However, only 2,449 stated the location of their first job. We drop 482 bachelor graduates since they are interviewed while still enrolled in another degree (mostly a master's degree) and therefore are still students, who are less likely to move and more importantly whose job mobility we do not observe. After dropping the surveyed individuals who did not start working, did not work full-time, or did not state a realistic salary (between 10,000 and 72,000 Euros), 1,309 individuals remain for the analysis. This restriction is due to our interest in mobility for the first job and a credible set of university graduates having moved for the job and not for other reasons. Additionally, 180 individuals are return migrants, who studied at another university and then returned to Munich after graduating, and are not considered in the main analysis. In a robustness check, we include them again as non-movers in the second stage. The sample of the Munich LMR can then be split up further into 726 university graduates who went to a high school closer than 15 km to the city centre (606 of them in the city district), 320 who went to a high school within the doughnut, and 83 who went to a high school further away than 30 km from Munich's city centre.

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<sup>27</sup> However, especially for Munich, there could be additional migration to more distant destinations (outside of Bavaria) that we cannot observe in our data.

In Table 1, the sample is split into four categories: three categories within the Munich LMR and one containing all other surveyed university graduates (i.e. outside the Munich LMR). Within the Munich LMR, the three categories are the estimation sample, inside the sample doughnut, and outside the sample doughnut. For each sample, descriptive characteristics are provided. The estimation sample is very similar to the other categories regarding the descriptive characteristics. The only exceptions are that in the estimation sample almost all individuals have a general admission certificate and that the share of graduates from universities of applied sciences is a little lower at 25 per cent. Moreover, in this sample, more university graduates have experience abroad. Concerning their parental characteristics, both mothers and fathers are generally better educated, which is in line with expectations regarding the suburbs.<sup>28</sup>

## 6 Results

### 6.1 Effects of distance and early mobility

The results presented in this section show a statistically significant effect of early mobility (for university) on later mobility (for the first job). The results are presented in Table 2a.<sup>29</sup> Columns (1) through (3) show OLS estimates, whereas Columns (4) through (6) show IV estimates. In each case, first, our preferred specification with dummy variables for the county and controls for parental characteristics are shown. Second, only the county remains as control, and third, further control variables are added to ensure robustness.

The OLS results are strongly statistically significant below the 1%-level. In our preferred specification (Column 1), the fraction of those who move for the first job is 38 percentage points higher compared to non-movers. The estimate remains when the parental controls are removed (Column 2) and decreases slightly when further controls are added (Column 3).

In comparison, the IV results show a much higher, and also statistically very significant, effect (Columns 4 through 6). Again, the estimate remains robust when the parental controls are removed (Column 5). Hence, the parental background is less decisive for our research question. This is not surprising as we analyse movements but not the general decision to study or not, which is greatly influenced by parental characteristics as, e.g., Karen (2002)

<sup>28</sup> Corresponding to students' personal characteristics in Table 1, Table A.1 in the Appendix shows the descriptive statistics for parental characteristics. Figure A.1 in the Appendix shows correlations between the outcome variables of the first and second stage, the instrument, and the parental characteristics. The strongest correlation is between the two movements (.334). The instrument correlates more strongly with the first move (.200) than with the second move (.100). The correlations with the parental characteristics are rather low.

<sup>29</sup> The output with all controls is shown in the Appendix in Table A.2

Table 1: Difference in personal characteristics between groups (defined by high-school location)

	group of interest Mean/SD	Munich LMR: outside Mean/SD	Munich LMR: inside Mean/SD	outside Munich LMR Mean/SD
<b>personal characteristics:</b>				
Cohort	0.35 (0.48)	0.30 (0.46)	0.35 (0.48)	0.34 (0.47)
Female	0.46 (0.50)	0.41 (0.49)	0.47 (0.50)	0.39 (0.49)
Age	26.24 (1.94)	26.77 (3.00)	27.79 (4.58)	26.76 (3.02)
Grade (High School)	2.26 (0.59)	2.34 (0.53)	2.32 (0.60)	2.41 (0.59)
German	0.99 (0.10)	0.98 (0.16)	0.93 (0.25)	0.99 (0.11)
University of Applied Sciences	0.25 (0.43)	0.57 (0.50)	0.40 (0.49)	0.58 (0.49)
General admission certificate	0.95 (0.22)	0.53 (0.50)	0.68 (0.47)	0.59 (0.49)
Subject-related entrance qualification	0.02 (0.12)	0.14 (0.35)	0.08 (0.28)	0.13 (0.34)
Advanced technical college certificate	0.03 (0.17)	0.30 (0.46)	0.18 (0.38)	0.25 (0.44)
Children	0.03 (0.18)	0.06 (0.24)	0.06 (0.24)	0.06 (0.25)
Internship	0.74 (0.44)	0.67 (0.47)	0.66 (0.47)	0.69 (0.46)
Experience Abroad	0.43 (0.50)	0.30 (0.46)	0.30 (0.46)	0.31 (0.46)
Work Experience	0.92 (0.27)	0.92 (0.27)	0.92 (0.27)	0.89 (0.31)
Married	0.10 (0.30)	0.07 (0.26)	0.17 (0.39)	0.14 (0.36)
Single	0.26 (0.44)	0.39 (0.49)	0.28 (0.45)	0.31 (0.46)
Firm partner (living separately)	0.26 (0.44)	0.23 (0.42)	0.23 (0.42)	0.23 (0.42)
Firm partner (living together)	0.46 (0.50)	0.36 (0.48)	0.46 (0.50)	0.44 (0.50)
Economics and management	0.25 (0.43)	0.37 (0.49)	0.27 (0.45)	0.32 (0.47)
Engineering	0.17 (0.38)	0.17 (0.38)	0.15 (0.36)	0.26 (0.44)
Science	0.23 (0.42)	0.19 (0.40)	0.20 (0.40)	0.14 (0.35)
Observations	320	83	726	3160

Notes: Mean and standard deviation of personal characteristics.

shows. The IV estimate increases slightly and remains highly statistically significant when further control variables are added (Column 6).

The estimate increases from the OLS to the IV, meaning that the OLS estimate is downward biased. A priori, the direction of the bias is unclear. We can think of two omitted variables: preference for mobility and financial restrictions. An unobservable preference for mobility would bias the estimate upwards. However, financial restrictions or the parents' willingness to cover the rent at a new place would bias the estimate in the other direction. Comparing the financial side and personal preferences, it is likely that the financial effect dominates and that we, therefore, estimate a downward biased coefficient.

The instrument is relevant. The first stage estimate is statistically highly significant and around 0.02 in all specifications (Table 2a), indicating that a 1 km increase in distance increases the probability of moving for university by 2 percentage points. Hence, a high-school graduate located near to the outer border is nearly 30 percentage points more likely to move to another university than a high-school graduate located near to the inner border. The reduced form (intention to treat) is presented in Table 2b and shows a highly statistically significant and robust effect across all specifications of around 0.02.

Table 2: Regression results

(a) OLS & IV

	(1) OLS	(2) OLS	(3) OLS	(4) IV	(5) IV	(6) IV
Moved for university	0.383*** (0.0823)	0.383*** (0.0814)	0.319*** (0.0923)	1.012*** (0.365)	0.948*** (0.343)	1.318** (0.565)
<i>First Stage</i> Distance to university				0.0182*** (0.00577)	0.0187*** (0.00577)	0.0159*** (0.00657)
county FE	X	X	X	X	X	X
parental controls	X		X	X		X
further controls			X			X
observations	320	320	270	320	320	270
F Statistic				9.956	10.448	5.825

(b) Reduced form (intention to treat)

	(1) Moved for first job	(2) Moved for first job	(3) Moved for first job
Distance to university	0.0184*** (0.00635)	0.0177*** (0.00626)	0.0209*** (0.00725)
county FE	X	X	X
parental controls	X		X
further controls			X
observations	320	320	270
R <sup>2</sup>	0.057	0.047	0.113

Standard errors in parentheses

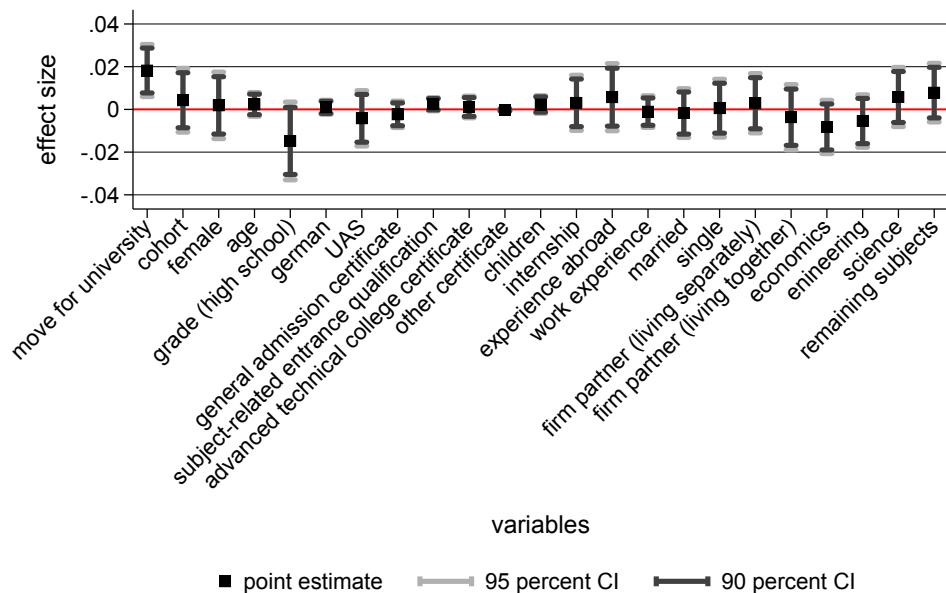
\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

*Notes:* Dependent variable: Moved for job. Instrument: Distance to university. Robust standard errors. All results contain fixed effects for the county. Parental Control: father's occupational status (four categories). Further controls: gender, age, nationality, cohort, type of entrance diploma, high-school grade, subject of study (economics, engineering, science, remaining subjects), type of university, children, partnership, high-school grade, internship, and lived abroad. Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

## 6.2 Threats to identification

In an instrumental variable approach, it is important that the instrument is not only relevant, but also that the exclusion restriction holds. Though the exclusion restriction cannot be tested directly, one can re-estimate the first stage with placebo outcomes (e.g. Eggers et al., 2021 & Falck et al., 2014). Hence, we challenge the exclusion restriction by changing the instrumented variable. We regress the same instrument against all observable controls and show that for all 22 variables the estimate misses statistical significance at the 10%-level (Figure 3).<sup>30</sup> For comparison, the first estimate shows the first stage effect again (Table 2a). For instance, a selection problem in the data, as only high-school graduates who finished university are considered, could be a problem with the IV. On the one hand, intellectual capacity of enrolled students could decrease with distance to university, e.g. because university-educated parents are more likely to have stayed or found jobs closer to the city. On the other hand, only students with excellent high-school grades might be willing to enrol at a university even though they live far away from it. At the same time, students from more closely located high schools might enrol at a university even with lower grades. We evaluate this argumentation by using the high-school diploma (average) grade as a proxy for intellectual capacity and regress it on the instrument. The results are not statistically significant.

Figure 3: Exclusion restriction (with parental controls)



*Notes:* In this figure, the control variables are regressed on the instrument (distance to university). All results contain fixed effects for the county. Parental Control: father's occupational status.

<sup>30</sup> The estimate of age is rescaled by the factor ten for visibility reasons

The observed bias could also be due to a different selection into the sample. With greater distance, the likelihood of enrolling at a university is affected as well (e.g. Kjellström and Regnér, 1999; Frenette, 2006 & Spiess and Wrohlich, 2010). However, this has so far only been shown in different setups and based on greater distances. Nevertheless, if distance drives the decision not to study, those who enrol at a university might be those who only face the decision to move or not to study, instead of moving to study or not moving to study. We observe that with distance to university, the number of observations per high school is not affected (Table A.3 in the Appendix). Hence, this argument does not apply in our case as we consider commuting distances between 15 and 30 km. The survey only contains university graduates. Therefore, we cannot directly test whether distance influences the overall decision to study.

Furthermore, looking at the map in Figure 2 illustrates that the Munich LMR is relatively close to the city of Augsburg. Therefore, the University of Augsburg might become the relevant university for some individuals. However, this proximity does not affect our results as we consider only the immediate suburban region of Munich. Even the high schools located closest to the outer border are still much closer to Munich than to Augsburg. Also, public transport in this area is much more oriented towards Munich, making commuting to Munich much easier, faster, and cheaper than to Augsburg.

Concerns that the local average treatment effect (LATE) identified by a variation in the distance could differ from that of other policies such as reduced tuition should apply less to our study (Carneiro et al., 2011; Imbens and Angrist, 1994). Unlike studies about the returns to education, our analysis is primarily concerned with the effect of early mobility on later mobility. Hence the potential self-selection into the first is likely similar to the one into later mobility. Therefore the treated population of students for which we identify the relationship between early and later mobility is likely to be similar to the population that would be affected by policies inducing mobility. Complementarities of policies with other characteristics thus play a minor role for policy relevance compared to studies about the returns to college (Nybom, 2017).

### 6.3 Robustness

The results remain robust to a wide range of observable controls as shown in Table 2, Column (6).<sup>31</sup> Table 3 shows further robustness checks. Column (1) shows the baseline results for comparison.

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<sup>31</sup> Table A.4 in the Appendix changes the set of control variables slightly by providing more categories of the student's subject.

**Return migration** In Column (2), we add those to the sample, who moved after high school but returned to Munich for the first job, and treat them as not having moved for the first job. As it is unclear how to treat them, we included this group in this robustness check. The estimate decreases, which is unsurprising as by definition this entire group moved for university but did not move for the first job by returning to Munich. Nevertheless, even in this specification, the estimate remains relatively high and statistically significant.

**Probit IV** In Column (3), we estimate a probit IV as both the dependent and the explanatory variable are dummy variables. The marginal effect from the probit model shows that a graduate who moved for university is nearly three times more likely to move for the first job than a graduate who studied in Munich.

**Administrative approach** Instead of using distances, we can define the sample by administrative units. When including all observations in the Munich LMR which are not located in the administrative district of the city of Munich the sample increases to 523 individuals as more observations closer to the centre and at the outer border of the LMR are included (Column 4). This is the most general sample and the results remain unchanged.

**Distance measures** We also show that our approach is still suitable and results stay robust if travel time with public transport (Column 5), travel time by car (Column 6), linear (Euclidean) distance (Column 7) rather than street distance, and the logarithm of the street distance (Column 8) are considered. For public transport, the estimate decreases slightly. However, the F-statistic increases, indicating that the travel time by public transport is very relevant for the first movement decision. Overall, these robustness checks indicate that the results do not depend on a specific distance measure.

**Distance thresholds** We present robustness checks with different cut-off points. Instead of setting the outer boundary at 30 km, we gradually expand the size of the group of interest by varying the values of the outer boundary between 30, 32.5, 35, and all above 35 km. For the inner boundary, we again gradually expand the size of the group of interest by varying the values of the boundary between 5, 7.5, 10, 12.5, and 15 km. Figure 4 shows a very robust effect size.

**Parental characteristics** In our main specification, we only control for the father's occupational status, arguing that it is the best proxy for family income and that it is correlated with the father's educational level and the mother's characteristics. Figure 5 shows that the results stay

Table 3: Robustness

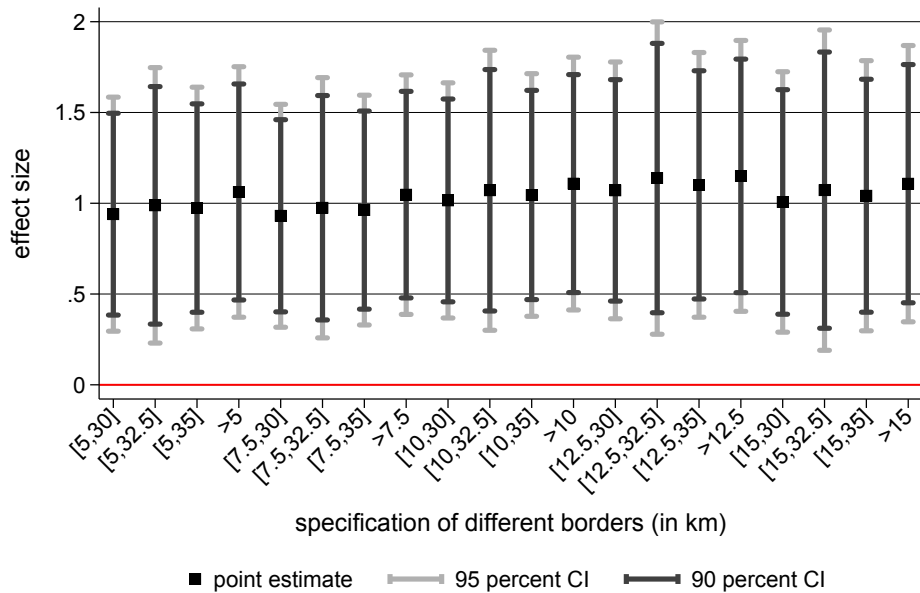
Moved for first job	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Moved for university	1.012*** (0.365)	0.574** (0.250)	2.988*** (0.452)	1.062*** (0.352)	0.645** (0.276)	1.270** (0.495)	1.157*** (0.436)	1.036*** (0.378)
county FE	X	X	X	X	X	X	X	X
parental controls	X	X	X	X	X	X	X	X
return migration included		X						
log instrument								X
probit			X					
public transport					X			
duration by car						X		
linear distance							X	
administrative approach				X				
observations	320	377	320	523	320	320	320	320
F Statistic	9.956	15.934	.	8.160	14.716	6.355	7.998	9.529

Standard errors in parentheses

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Notes: Dependent variable: Moved for job. Robust standard errors. All results contain fixed effects for the county. Parental Control: father's occupational status (four categories). Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Figure 4: Robustness of estimates when changing distances of the borders

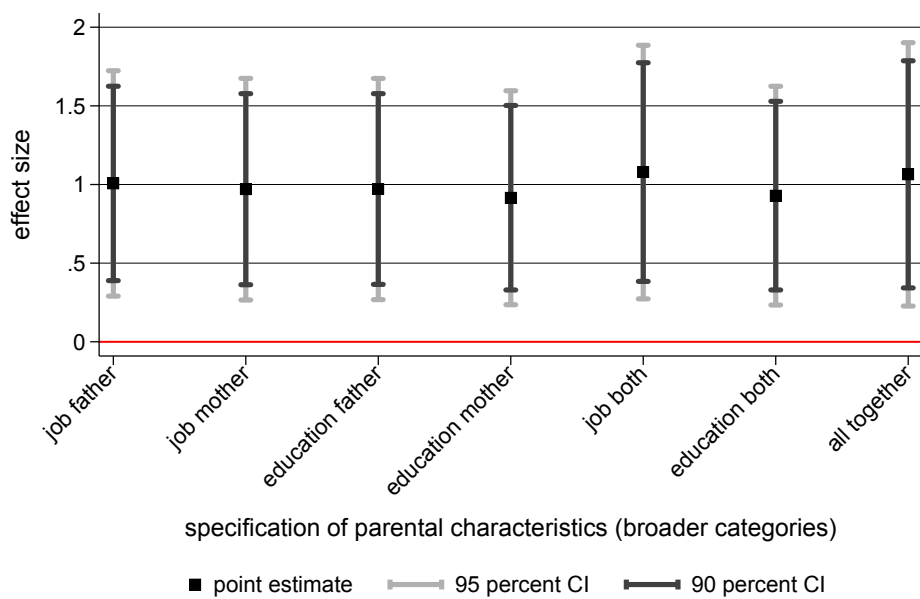


Notes: This figure depicts the robustness of the main effect with respect to varying the distance threshold to define the estimation sample. All results contain fixed effects for the county and controls for the father's occupational status.



robust when varying or adding parental controls. The first estimate shows the baseline as in Table 2a, Column (4). The second estimate contains the mother's occupational status instead of the father's occupational status. The next two estimates include the respective educational level instead of the occupational status. The final three estimates combine these controls: first, the occupational status of both parents is considered; then, the educational level of both, and finally, both the occupational status and the educational level of both parents. The results show that including these controls does not alter the direction of our results significantly.<sup>32</sup>

Figure 5: Robustness of estimates when controlling for different parental characteristics (broader categories)



*Notes:* This figure depicts the robustness of the main effect with respect to controlling for different parental characteristics. All results contain fixed effects for the county.

## 7 Conclusion

Regional economic development and the effectiveness of place-based policies crucially depend on the mobility of high-skilled labour. In our investigation, we examine the decision to move or stay when enrolling at a university as a determinant for early regional job mobility. To do so we employ an instrumental variable approach to get exogenous variation in the decision of where to enrol at a university. We add to the literature by investigating the regional

<sup>32</sup> We define rather broad categories (four for occupation and three for education). However, in Figure A.2 in the Appendix, variables with more categories are used (16 for occupation and eight for education). The results remain robust in all specifications.

mobility of high-school graduates in a metropolitan area when starting university and upon graduation. While studies related to ours through the proximity instrument have focused on university enrolment as the main outcome, papers that study the relationship between early and later mobility have shown only correlations.<sup>33</sup> Our paper contributes by identifying the effect of the decision to leave one's home LMR to study elsewhere on later job mobility. Our results suggest that those who move to another LMR for university are significantly more mobile when entering the job market.

To examine potential threats to the identification strategy, we apply several robustness checks, one of which shows that the results are not sensitive to the selection of the exact area we investigate. The results are also robust to a variety of additional control variables.

Understanding the determinants of university graduates' mobility has important policy implications for multiple reasons. First, increasing mobility may be a policy goal for labour market efficiency as well as distributional concerns. Increasing workers' mobility can improve match quality by increasing both the number of potential workers for firms and suitable positions for job seekers. Fahr and Sunde (2006), for instance, present evidence for the importance of spatial dependencies and the level of worker mobility for the efficiency of the job matching process. When mobility *away* from a large agglomeration is affected, as in our setting, it may also be a policy instrument to reduce regional disparities. Second, mobility determines which LMRs benefit or lose and at which level of administration policies should be enacted.<sup>34</sup> Third, policies to increase the number of high-skilled workers in a region (rather than to increase mobility across regions in general) could be more effective if they aim to retain local students rather than if they try to attract university graduates from elsewhere. Creating opportunities for local students may be socially optimal if mobility is associated with significant (but hard to quantify) costs to the individual such as sacrificed social ties. Thus, a better understanding of graduate mobility is crucial for successful place-based policies aiming to strengthen economically weaker regions and counterbalance the natural advantages of agglomerations (Kline and Moretti, 2014).

Our study shows that the mobility of high-school graduates when starting university is a powerful lever to affect future mobility. On the one hand, if regional disparities are to be reduced, policymakers may want to incentivise students to move away from the state's largest agglomeration to study. This could increase the probability that they contribute to local development in other regions in the future. Increasing inter-regional labour mobility, in

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<sup>33</sup> Studies related to the instrument and university enrolment include Kjellström and Regnér (1999), Kling (2001) and Frenette (2006). Another difference between these studies and ours is that we use variation in distance at a much finer level. Ciriaci (2014) and Faggian et al. (2007) are examples of studies that find a relationship between early and later mobility.

<sup>34</sup> Geissler and König (2021) provide a recent overview of the literature on the potential for free-riding on other regions' higher education financing. Their study finds some evidence that incentives to free-ride exist for German states.

general, might also benefit labour market efficiency overall. On the other hand, if knowledge workers are expected to be more productive in larger agglomerations (e.g. Moretti, 2021), it could be efficient (and in the metropolitan area's own interests) to implement policies to retain talent. This could be achieved by preventing high-school graduates from moving away through subsidised dormitories or tickets for public transportation.

## Notes

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## A Appendix

Table A.1: Difference in parental characteristics between groups (defined by high-school location)

	group of interest Mean/SD	Munich LMR: outside Mean/SD	Munich LMR: inside Mean/SD	outside Munich LMR Mean/SD
<b>parental characteristics:</b>				
Mother's job qualification: low	0.13 (0.33)	0.18 (0.39)	0.19 (0.39)	0.20 (0.40)
Mother's job qualification: medium	0.62 (0.49)	0.64 (0.48)	0.55 (0.50)	0.61 (0.49)
Mother self-employed	0.15 (0.36)	0.05 (0.22)	0.13 (0.34)	0.09 (0.28)
Mother's job qualification: high	0.08 (0.27)	0.10 (0.30)	0.10 (0.30)	0.07 (0.26)
Father's job qualification: low	0.03 (0.16)	0.02 (0.15)	0.07 (0.25)	0.06 (0.24)
Father's job qualification: medium	0.29 (0.45)	0.30 (0.46)	0.34 (0.47)	0.42 (0.49)
Father self-employed	0.22 (0.41)	0.25 (0.44)	0.22 (0.41)	0.20 (0.40)
Father's job qualification: high	0.45 (0.50)	0.39 (0.49)	0.35 (0.48)	0.29 (0.45)
Mother's education: high	0.27 (0.45)	0.12 (0.33)	0.21 (0.41)	0.12 (0.33)
Mother's education: medium	0.10 (0.30)	0.04 (0.19)	0.08 (0.27)	0.06 (0.24)
Father's education: low	0.35 (0.48)	0.48 (0.50)	0.48 (0.50)	0.60 (0.49)
Father's education: medium	0.18 (0.39)	0.16 (0.37)	0.17 (0.37)	0.16 (0.36)
Father's education: high	0.45 (0.50)	0.30 (0.46)	0.33 (0.47)	0.22 (0.41)
Observations	320	83	726	3160

Notes: Mean and standard deviation of parental characteristics.

Figure A.1: Correlation matrix with parental characteristics



Notes: This figure depicts correlation between the variables of interest (movements and distance) and the parental characteristics.

Table A.2: Full output

	(1) OLS	(2) OLS	(3) OLS	(4) IV	(5) IV	(6) IV
Moved for university	0.383*** (0.0823)	0.383*** (0.0814)	0.319*** (0.0923)	1.012*** (0.365)	0.948*** (0.343)	1.318*** (0.565)
Father's job qualification: low	0.110 (0.123)		0.100 (0.181)	0.121 (0.120)		0.0611 (0.183)
Father's job qualification: medium	0.102** (0.0457)		0.0444 (0.0877)	-0.00191 (0.0747)		-0.0832 (0.134)
Father self-employed	0.0972** (0.0444)		0.0458 (0.0948)	0.0275 (0.0616)		-0.00950 (0.128)
Father's job qualification: high	0.153*** (0.0394)		0.0768 (0.0905)	0.0859 (0.0524)		0.00692 (0.121)
Cohort			0.0186 (0.0610)			-0.102 (0.101)
Female			-0.0660 (0.0527)			-0.166* (0.0942)
Age			-0.000119 (0.0147)			0.00368 (0.0189)
Grade (High School)			0.0471 (0.0438)			0.0390 (0.0592)
German			0.137 (0.0955)			0.0125 (0.117)
University of Applied Sciences			0.0308 (0.0838)			-0.0141 (0.0980)
General admission certificate			0.0609 (0.0984)			-0.295 (0.240)
Subject-related entrance qualification			-0.0518 (0.144)			-0.250 (0.225)
Advanced technical college certificate			0.0102 (0.182)			-0.163 (0.231)
Children			-0.0698 (0.132)			-0.265 (0.202)
Internship			0.0157 (0.0596)			-0.0425 (0.0762)
Experience Abroad			0.00550 (0.0497)			-0.0157 (0.0653)
Work Experience			-0.00747 (0.0778)			0.0455 (0.102)
Married			-0.00247 (0.0922)			-0.0249 (0.106)
Single			0.299** (0.132)			0.574* (0.338)
Firm partner (living separately)			0.251* (0.128)			0.642* (0.368)
Firm partner (living together)			0.260** (0.118)			0.677* (0.378)
Economics and management			0.0943 (0.0736)			0.218* (0.117)
Engineering			-0.0324 (0.0848)			0.0797 (0.112)
Science			-0.0246 (0.0711)			0.111 (0.128)
Constant	0.0822 (0.117)	0.218* (0.114)	-0.485 (0.394)	0.109 (0.111)	0.171 (0.111)	-0.463 (0.559)
county FE	X	X	X	X	X	X
parental controls	X		X	X		X
further controls			X			X
observations	320	320	270	320	320	270
F				9.956	10.448	5.825

Standard errors in parentheses

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ 

Notes: Dependent variable: Moved for job. Instrument: Distance to university. Robust standard errors. All results contain fixed effects for the county. Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$



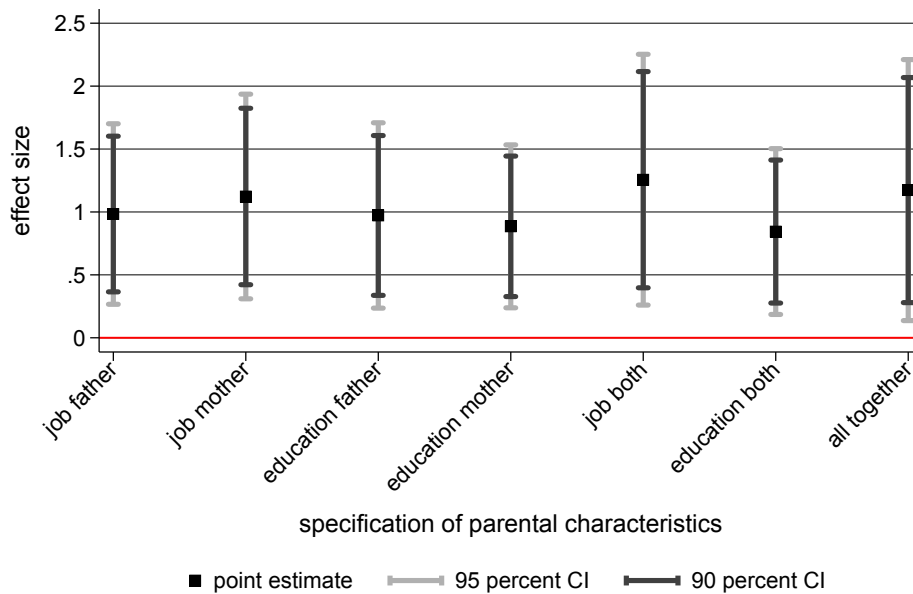
Table A.3: Number of high-school graduates per school

	(1)	(2)	(3)	(4)
	OLS	OLS	OLS	OLS
Distance to university	-0.524 (0.484)	-0.786 (0.620)		
Distance to centre			-0.498 (0.558)	-0.759 (0.669)
county FE		X		X
observations	20	20	20	20

Standard errors in parentheses  
\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Notes: Dependent variable: Aggregated number of surveyed university graduates per high school. Robust standard errors. Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

Figure A.2: Robustness of estimates when controlling for different parental characteristics



Notes: This figure depicts the robustness of the main effect with respect to controlling for different parental characteristics with very narrow definitions of the occupation/education. All results contain fixed effects for the county.

Table A.4: Robustness: Broad versus narrow definition of subjects

	(1) OLS	(2) OLS	(3) IV	(4) IV
Moved for university	0.319*** (0.0923)	0.314*** (0.0899)	1.318** (0.565)	1.158** (0.515)
county FE	X	X	X	X
parental controls	X	X	X	X
further controls	X	X	X	X
subject definition	broad	narrow	broad	narrow
observations	270	270	270	270
<i>F</i>			5.825	6.207

Standard errors in parentheses

\*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$

*Notes:* Dependent variable: Moved for job. Instrument: Distance to university. Robust standard errors. All results contain fixed effects for the county. Parental Control: father's occupational status (four categories). Broad subject definition: economics, engineering, science, remaining subjects. Narrow subject definition: economics (business administration, business informatics, industrial engineering, and economics), engineering (civil and environmental engineering, electrical engineering, information technology, and mechanical engineering/materials), science (applied natural sciences, biology/biological sciences, chemistry, computer science, mathematics, and physics), and remaining subjects (English/American studies, architecture, education, geography, German studies, legal studies, pharmacy, political science/social sciences, psychology, Romance studies, social work, sports/sports science, and missing subjects). Further controls: gender, age, nationality, cohort, type of entrance diploma, high-school grade, type of university, children, partnership, high-school grade, internship, and lived abroad. Standard errors in parentheses. \*  $p < 0.1$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$