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Does Spatial Mobility in Young Adulthood Matter?
Indirect and Direct Effects of Spatial Mobility During Education on Occupational Status

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Abstract

Spatial mobility after leaving high school for further education is a dominant part of the transition to adulthood and accounts for a large proportion of total internal migration dynamics. Yet, it has been neglected in studies of social mobility. This study explores the link between spatial mobility during post-secondary education (for distances of at least 50 km) and occupational status acquired three years after finishing education, once young adults have had time to settle in the labor market. Starting from a path model, the goal is to identify the average indirect effect of spatial mobility operating though the mediator education, situated on the path between spatial mobility and occupational status as well as the (unmediated) direct effect.

Direct and indirect effects are estimated via a novel inverse probability weighting (IPW) approach to account for the fact that selection into spatial mobility as well as into the mediator education is non-random and may bias the direct and indirect effect estimates. Analyses are based on nine waves of the Adult Cohort of the German National Educational Panel Study (NEPS), a representative, multicohort sample of German residents containing complete retrospective and prospective multidimensional information on individual life-courses. Contextual information on district-levels are matched with the data reflecting local educational opportunities when leaving high school as well as the degree of urbanization.

Findings show that the mobile population is a highly selective group predestined towards career success, because they are achievement-oriented from the beginning and because they enjoyed pro-educational family environments. Yet, an unmediated direct effect of spatial mobility on occupational status remains, even after accounting for confounding factors. Thus, this study indicates that taking advantage of educational opportunities at distant locations may be beneficial to the social mobility of young people beyond educational advancement. Moreover, the results point towards effect heterogeneity in that spatial mobility increases socio-economic positions especially for those with disadvantageous starting positions.

Introduction

Social mobility represents the movement of people between hierarchically ordered social positions in a society, whereas spatial or geographic mobility is the movement of people from one place to another. Throughout a person's life, spatial and social mobility are often linked, yet the one is not necessarily a condition for the other (Kley, 2016, p. 496).

In contemporary societies, a direct link between spatial and social mobility becomes most evident in economic models of long-distance migration as investment (e.g., Bowles, 1970; Riew, 1973; Sjaastad, 1962; Schultz, 1961). Although migration can imply losses in location-specific capital (DaVanzo, 1981), it allows individuals to take advantage of career opportunities at distant locations and can promote upward inter- and intragenerational social mobility (Sandefur and Scott, 1981; Wilson, 1985)[1]. Several factors, especially those pertaining to local integration or the family lifecycle, may prevent individually and economically beneficial migration (e.g., Abraham and Nisic, 2012), but migration-investment models find broad empirical support in cases where job changes involve regional or international migration (Cebula, 2005; Fuller, 2008; Greenwood, 1975; Mulder and van Ham, 2005; Reichelt and Abraham, 2017; Yankow, 2003). Individuals may also be constrained to spatial mobility, either within or between organizations, if they want to advance in their careers (Hacket, 2009; Johnson and Salt, 1980; Savage, 1988).

Contemporary social theorists have pointed more generally towards a strong valorization of spatial mobility as a road to individual advancement inscribed in the prevailing liberal market model (Kesselring, 2008; e.g., Kaufmann *et al.*, 2004). However, returns to spatial mobility that are not directly associated with job transitions or institutionalized career paths have played a minor role in empirical studies on social mobility (Savage, 1988; for exceptions, see Fielding, 1992; Viry *et al.*, 2010; Viry *et al.*, 2014). This applies to social and spatial mobility at the transition to adulthood as well, a period when geographic mobility is greater than in any other period of life, that can best be understood from a life-course perspective. Following the life-course approach, a change of residence taking place early in the life-course may well affect the opportunity for occupational advancement later in life. It is a guiding principle of life-course and social mobility research that "[t]he consequences of early decisions have compound effects on future trajectories" (Lui *et al.*, 2014, p. 4, see also Coulter *et al.*, 2016).

[1] The secular decline in the rate of US interregional migration that has been witnessed since the 1970s has hence led to the concern that geographical mobility may have ceased to provide individuals with opportunities for economic advancement (Cooke 2011; Ferrie 2005; Molloy *et al.* 2017; Partridge *et al.* 2012). Some scholars have pointed out that migration rates in the US are converging towards the lower levels historically observed in Europe, where the proportion of interregional migrants in the total population has always been much smaller than in the US (Partridge *et al.* 2012; Puhani 2001).

This life-course perspective finds an early expression in the book *The American Occupational Structure* by Blau and Duncan (1967), which has subsequently influenced much social stratification and mobility research. Blau and Duncan studied social mobility processes and status attainment longitudinally across individual life-courses in the US. They argued that, over the long run, geographic mobility may turn the ascriptive influence of birthplace into an opportunity for achievement, i.e. "free[…] a man from the restraints and influences his childhood environment imposes on his career" (Blau and Duncan, 1967, p. 251). They argue that, in contrast to gender or race, the spatial location of persons is not a constant feature over the course of the person's life. This seems to apply not least in modern individualized societies, for which it is assumed that individual biographies and lifestyles are less bound by geographical origin and social ties than in traditional class-based societies (e.g., Beck *et al.*, 1994). Geographic mobility in young adults' lives has also been found to be a "turning point" in the transition to adulthood especially for disadvantaged and rural youths with lasting effects on social independence, socio-economic status, and economic well-being (Elder *et al.*, 1995; Kirkpatrick Johnson *et al.*, 2005; Lindgren and Lundahl, 2010; Rieger, 1972; Sampson and Laub, 1996).

Overall, however, spatial mobility and its long-term impact on individual social mobility has not been a central focus of quantitative social science research (Coulter *et al.*, 2016; Goodwin-White, 2016; Mulder and van Ham, 2005; Rye, 2006; Savage, 1988). In particular, possibly due to the shortage of suitable data, spatial mobility behavior of the highly mobile group of young adults after they leave high school and before they enter the labor market has received little systematic scholarly attention (Faggian and Franklin, 2014; Leopold *et al.*, 2012). According to geographers Darren P. Smith and Heike Jöns (2015, p. 48) "the sub-national migration dynamics of individuals and families moving for education-related factors has, to date, not been fully acknowledged in an explicit way, or effectively conceptualized within geographic or migration studies scholarship." For the German context, Michael Wagner has established thirty years ago that "[w]hile regional characteristics and spatial mobility have been taken into account in the analysis of social mobility [in the USA], at least since the pioneering work of Blau/Duncan (1967), there is only isolated work in the field of social structure analysis in the Federal Republic of Germany which includes such factors […]. This neglect has never been systematically justified" (1990, p. 125, own translation). Interestingly, not much has changed since.

With this study I want to (re-)open discussions on the linkages between social and spatial mobility. I analyze whether spatial mobility during a person's post-secondary educational career impacts occupational attainment three years after the person has entered the labor market. The overriding research question is whether such education-induced spatial mobility itself influences the acquisition of higher occupational positions or whether spatial educational mobility is merely instrumental in gaining higher educational degrees, in which case higher educational achievement mediates the

relationship between spatial and social mobility. Spatial and educational transitions are thus modelled as distinct and independent life-course transitions, leading to a conceptual separation that is not evident in previous research.[2] In addition, since the selectivity of the migrant population is well-known and has been shown to distort the relationship between migration and the outcomes of migration, the empirical analysis will account for self-selection of those spatially mobile during education based on relevant observed confounders (e.g., Cooke and Bailey, 1996; Smits, 2001). Moreover, spatial mobility cannot be decontextualized as individual choice, but is dependent on place-based opportunities (Reimer, 2013; Viry *et al.*, 2010, p. 156), so that selected regional context data are taken into account as well.

The analysis is based on micro-level, multi-cohort, retro- and prospective data from starting cohort 6 (SC6) of the German National Educational Panel Study (NEPS). SC6 has a total sample size of about 10,000 German residents born between 1944 and 1986. It allows the identification of the respondents' entire educational trajectories as well as educational locations on a district-level (German *Kreise*), of which there are currently more than 400. Based on the potential outcomes framework (Morgan and Winship, 2015; Rubin, 2005), a path model of the effect of a person's spatial mobility during educational transitions on his or her occupational status three years after finishing education is tested. The potential outcomes framework has been useful in assessing treatment effects of interventions that do not allow for randomized experiments (Rubin, 2005). It holds that inference in observational studies is based on a missing data problem: when comparing the individual-level effect of an intervention/treatment, we can only observe one of the potential outcomes, since a person can never be part of the intervention and the control condition at the same time. The unobserved potential outcomes for a given person must therefore be estimated based on covariates that influence selection into the treatment.

Following this logic, education-induced spatial mobility is conceptualized as a binary treatment indicator with two different distance thresholds. It takes a value of 1 when the distance between the district midpoints of the last secondary education spell and a post-secondary education spell, or of two post-secondary educational spells, is larger than 50 or 100 km, respectively. It takes a value of 0 otherwise. The analytical model is identified through a combination of inverse probability weighting based on propensity scores and a mediation approach developed by Bodory and Huber (2018) implemented in the statistics software R.

[2] Similarly, Swanson and Schneider (1999) have argued for analytically distinguishing between the effect of high school mobility and educational transitions on educational achievement outcomes.

Theoretical considerations

What causes the comparative success of spatially mobile persons? I discuss four possible explanations that account for the link between spatial and social mobility: migrant selectivity, opportunity structure, investment in educational capital, and learning experience. The following section situates these explanations in relation to prior research.

Migrant selectivity

A basic finding by Blau and Duncan was that "[…] migration is selective of men predisposed to occupational success" (1967, p. 257). Migration has long been recognized as a self-selecting process in which migrants systematically differ from the population of non-migrants depending on the context of migration decision-making (e.g., Borjas, 1987; Cobb-Clark, 1993; Shryock, JR. and Nam, 1965). Most researchers studying (long-distance) migration find several factors that affect an individual's propensity to migrate, including education, ability, motivation, aspirations, and attitudes towards risk (Gabriel and Schmitz, 1995; Greenwood, 1997; Yankow, 1999, p. 269). This self-selection leads to biased estimates of migration outcomes if the relevant confounders are not adequately accounted for. The assumption of migrant selectivity manifests itself most prominently in the fact that regions experiencing net outflows of people are concerned about losing valuable human capital (*brain drain*), thus aggravating processes of regional economic decline.[3]

Education-induced spatial mobility has been shown to be selective of individuals predisposed to educational and occupational achievements as well. Most importantly, prospective students from lower status families have been found to be less regionally mobile than prospective students from higher status families (Denzler and Wolter, 2010; Flannery and Cullinan, 2014; Gibbs, 1995; Helbig *et al.*, 2017; Holdsworth, 2009; Leopold *et al.*, 2012; Lörz, 2008; Meusburger, 2008). The literature offers various explanations for these status-related barriers to spatial mobility: children from low status families compared to children from middle and high status families have less financial means to support living across greater distances from home, they are more emotionally and socially attached to home, they are less tolerant of the general uncertainty in new places, and they are less resourced to get information about educational opportunities at alternative locations. Moreover, spatial mobility in the course of studies, whether intranational or international, may also function as

[3] In Germany, for example, selective migration from the East to the West after re-unification is subject to wide public and scientific debates given a significant deficit of young educated females in East Germany (e.g., Kröhnert and Vollmer 2012; Kubis and Schneider 2009).

"elite practice", where mobility is used to gain distinction by high-status groups from their non-mobile peers (Heinemann and Krawietz, 2008; Sellar and Gale, 2011; Tindal *et al.*, 2015).

In addition, psychological explanations have emphasized the role of unobserved factors such as motivation and general career and achievement orientation underlying migration behavior (Howell, 1981; Malke *et al.*, 2010; Rieger, 1972; Ritchey, 1976). "Youths with an achievement orientation migrate in pursuit of higher education and occupations not available in the local area. […] [A]chievement orientation affects migration only through its effect on prompting higher educational attainment" (Ritchey, 1976, p. 388). Unobserved differences between individuals cannot be ignored, and can at least partially be handled by approaching them via observable states such as pre-migration educational achievements.

Opportunity structure

Given that "[a]ll action takes place within a context" (Kaufmann, 2014, p. 7) the correlation between spatial and social mobility may not only be confounded by selectivity of migrants based on personal characteristics, but also by contextual conditions and opportunity structures that influence migration and change after migration. Persons living in areas of poorer educational opportunities move to areas that offer better opportunities for career advancement and social mobility. Alternatively, remaining in places with limited employment opportunities will severely affect young people's life chances (Evans, 2016). It may thus be the regional context and not spatial mobility as such that would influence relative occupational success of migrants: "it is difficult to rule out the hypothesis that migrants enjoy an advantage primarily due to participation in a more favorable opportunity structure" (Duncan et al. 1972, cited in Hagan *et al.*, 1996, p. 369). Especially rural youth, who often lack socioeconomic opportunity at home, need to migrate for educational and economic opportunity (Elder *et al.*, 1995; Kirkpatrick Johnson *et al.*, 2005; Ritchey, 1976; Walker, 2010).

The importance of context for young adult migrants becomes most evident in Anthony Fielding's work on "geographies of opportunities" (Fielding, 1992; Fielding and Halford, 1993). He popularized the idea of "escalator regions" showing that the regional context of South East England structures the options for social mobility of young adults migrating to that region in promoting them at rates higher than elsewhere in the country. In sum, one needs to include knowledge about the regional constraints for the movement of people as well as knowledge about regional opportunity structures that in turn frame conditions for spatial and social mobility.

Investment in educational capital

Spatial mobility varies systemically over the life-cycle and tends to coincide with other life plans, especially regarding investments in educational and occupational goals. Young adults between the ages of about 20 to 30, when educational and occupational choices accumulate, are thus the most geographically mobile persons in the population (for Germany, see Milbert and Sturm, 2016; Sander, 2014, 2018). Age-selective patterns of spatial mobility are observed in most countries in the world demonstrating that migration age profiles mirror key life course transitions (Bernard *et al.*, 2014; Geist and McManus, 2008; Kley and Mulder, 2010; Sander and Bell, 2016) and that educational transitions and mobility experience are closely intertwined (Viry *et al.*, 2010, p. 170).

Educational transitions at the end of secondary education thus dominate the larger phenomenon of age-selective migration (Bernard *et al.*, 2016, p. 135). Pursual of higher educational levels may require migration, stressing the instrumental perspective on spatial mobility. In order to reach higher educational levels young people are willing to leave the parental home and move long distances (e.g., Lawton *et al.*, 1994; Shelton and Grundy, 2000). Investments in migration would then primarily reflect an investment in educational capital that leads to professional success without spatial mobility having an effect of its own (Sabot, 1987).

Learning experience

Spatial mobility may yet also directly impact occupational success, because it gives rise to experience and personal development: „The act of migrating may itself constitute a learning experience allowing individuals to accumulate knowledge of how to avoid pitfalls, capitalize on opportunities, and evaluate the advantage offered by alternative locations" (Wilson and Tienda, 1988, p. 3). As part of one's vocational and academic education, traveling, wanderings, changes of location and institutions have always been valued as producers of new knowledge and experience; personality is said to grow in response to the challenges of new environments (Heinemann and Krawietz, 2008; Krawietz, 2008). Moreover, spatial mobility early in the life-course may put individuals in a better situation to cope with changes of location later in life, to maintain social ties across distances, and thereby improve their employment prospects on labor markets that demand a certain degree of spatial flexibility (e.g., Viry *et al.*, 2010).

In social psychological research, geographical mobility is believed to enable individuals to break with their personal family background, to develop new frames of reference, to gain personal autonomy, and to make identification with former status less definitive (Ellis, 1952, p. 562, see also Blau and Duncan, 1967, p. 251; Cicognani *et al.*, 2011; Elder *et al.*, 1995; El-Mafaalani, 2012; Sharkey and

Elwert, 2011). Based on the US-data from the Beginning Postsecondary Students Longitudinal Study, Garza and Fullerton show that first-generation students in particular increase their educational attainment prospects if they enroll in postsecondary schools located at greater distances from their parental home, because students seemingly "minimize obstacles that hinder their ability to achieve the levels of social, academic, and cultural integration in the postsecondary environment that translate into academic success" (Garza and Fullerton, 2018, p. 176).

So far, education-induced migrations have been considered primarily in terms of their impact on regional human capital allocation and retention as well as the economic potential of certain areas (Cooke and Boyle, 2011; Faggian and McCann, 2009; e.g., Haapanen and Tervo, 2012). Yet, while migration for education is a taken for granted life-course practice as well as a driver of macro-level economic growth (e.g., Börsch-Supan, 1990; Sabot, 1987; Schultz, 1961), only few studies consider whether such migration, beyond its coincidence with educational advancement, has an independent effect on the labor market success of the individual migrant.

Based on all four theoretical considerations stated above, I expect to find a strong correlation between spatial mobility during post-secondary education and social mobility. Adjusting for the selectivity of the mobile population will significantly reduce the effect of spatial mobility on occupational achievement. Moreover, given the strong linkage between educational and spatial mobility careers, a large part of the remaining relationship between spatial and social mobility will likely be mediated by the improvement of educational prospects. It remains to be seen whether there is a residual direct effect of spatial mobility on occupational status or whether education fully supersedes migration as mechanism of social advancement (argued, for example, by Ferrie, 2005). Before continuing with a description of the methods and the data, I will provide a brief background of research on spatial mobility connected to participation in post-secondary education with a focus on the situation in Germany.

Spatial mobility during post-secondary education in the German context

Overall internal migration is at lower levels in Germany than in many other Western countries (Sander, 2018). Germany has several regionally distributed, densely populated areas, only few large cities with more than one million inhabitants, less pronounced regional economic disparities than many other countries, and a decentralized *Mittelstand* well-known to be economically strong. These basic conditions dampen the overall need to be spatially mobile (ibid.).

Except for the group of young adults between the ages of about 20 and 30, spatial mobility has remained at stable levels in Germany (Milbert and Sturm, 2016; Sander, 2018). As educational expansion has gained traction in Germany and as more people leave secondary education with university entrance qualifications, migration of young people into areas that offer educational opportunities has increased substantially (Milbert and Sturm, 2016). Despite this overall trend towards greater spatial mobility among young adults, school-choice and student migration models consistently show that prospective students tend to enroll in post-secondary training opportunities closest to home and that so called "distance barriers" are among the most important factors deterring enrolment in higher education, (e.g., Alm and Winters, 2009; Cooke and Boyle, 2011; Frenette, 2006; Spiess and Wrohlich, 2010; Turley López, 2009). With increasing distance from home, as reflected in traditional gravity models of migration (Stouffer, 1940; Zipf, 1947), the material (financial) and immaterial (psycho-social) costs of leaving the parental home increase as well (Nutz, 2004).

The fact that most students take up studies close to home has been labeled "educational sedentariness" (*Bildungssesshaftigkeit*) in the German literature (Durrer and Heine, 1996; Frohwieser, 2002; Kosmützky and Ewen, 2016; Nutz, 2004; Reimer, 2013). Three quarters of those starting studies in Germany do so in the federal state where they received their university entrance qualification and this share has hardly changed over the last decades despite massive educational expansion (KMK, 2014, 2007, 2002). Based on the German School Exit Survey, Lörz (2008, p. 423) finds that 50 percent of university entrants live within 50 km from their parental home, only 20 percent move up to 100 km away from their hometown.

The persistent sedentariness of German higher education students can be attributed to the fact that educational expansion has taken place first and foremost in the sphere of universities of applied sciences (*Fachhochschulen*) that have far more regional recruitment practices than traditional universities (Fritsch and Piontek, 2015).[4] The number of universities of applied sciences rose substantially with the regional expansion of the higher education infrastructure in the 1960s and 1970s (Frohwieser, 2002). Universities of applied sciences have a greater regional economic importance than traditional universities, closer contacts with the local economy as well as a greater orientation of research and education towards the needs of the region (Nutz, 2004). Several universities of applied sciences also have secondary locations, which further increases the regionalized structure of the higher education system. It remains to be seen, whether demographic change and the rudimentary trend towards profile building, competition, and specialization among German higher education institutions

[4] Similarly, in the UK, it has been observed that educational expansion has come along with a growing trend for students to take up studies within their region of origin. More and more school leavers from nontraditional (non-academic) backgrounds participate in higher education and they more often chose to study close to their hometowns than traditional students did (e.g., Christie, 2007; Holdsworth, 2009; McClelland and Gandy, 2012; Patiniotis and Holdsworth (p. 229)

will increase the spatial mobility of young adults aspiring to higher educational degrees in the future (Freytag and Jahnke, 2015).

Given Germany's highly developed system of vocational education and training, dual vocational training is an attractive post-secondary education alternative to university studies for many young people especially in prosperous regions (Sander, 2018). While the transition rate to higher education has risen sharply in recent years, the number of people starting vocational training each year still surpasses the number of people opting for tertiary education (Dionisius and Illiger, 2015). In contrast to third level educational institutions, particularly traditional universities, training opportunities are spread more evenly across space. While participation in vocational training therefore depends less on individual migration behavior (Kubis and Schneider, 2007, p. 13), studies have shown that a certain degree of spatial mobility of vocational trainees is needed to reduce the regional mismatch between the demand and supply of training places, especially considering demographic changes and the imminent shortage of skilled labor (BIBB, 2015). In addition, acceptance of the view is growing that pursuing vocational training at some distance from home supports the maturation process of young adults, promotes their independence, and broadens their horizon in professional and social terms (Jobstarter Regional, 2015).

Survey data show that many prospective trainees are indeed prepared to apply to positions that are more than 50 km away from their place of residence, yet this mobility potential varies significantly by educational background of the applicants (BIBB, 2018). Accordingly, the proportion of spatially mobile trainees finishing high school at the highest level (*Abitur*) is significantly higher than among non-mobile trainees (Harten, 2013; Jost *et al.*, 2019; Kotte and Stöckmann, 2008; Seibert *et al.*, 2018; Wiethölter *et al.*, 2007). Highly-qualified trainees are likely to aspire to develop skills in occupations which are less available in peripheral regions. The selective spatial mobility behavior of vocational trainees thus confirms the well-established migrant selectivity mentioned above.

To conclude, transitioning to post-secondary education is a life-course phase marked by high spatial mobility. Yet, a substantial proportion of the young adult population in Germany is only hesitantly spatially mobile. In line with previous research on migrant selectivity and reflecting the regional distribution of training opportunities, spatial mobility declines with the educational level that individuals aspire to.

Model and Method

The empirical analyses have been carried out within the potential outcomes framework (POF). Following the POF, the occupational attainment of spatially mobile individuals is compared to the occupational attainment of these individuals if they had not been mobile. And vice versa, occupational attainment of nonmobile persons is compared to occupational attainment of these individuals if they had been mobile. The application of this counterfactual framework is a viable alternative to much of the previous research (similarly, see DaVanzo, 1981) that has long discussed the question of what the appropriate comparison group for mobile persons is – the population either of the region of origin or of the region of destination, both with its advantages and disadvantages (Greenwood, 1997, p. 689).

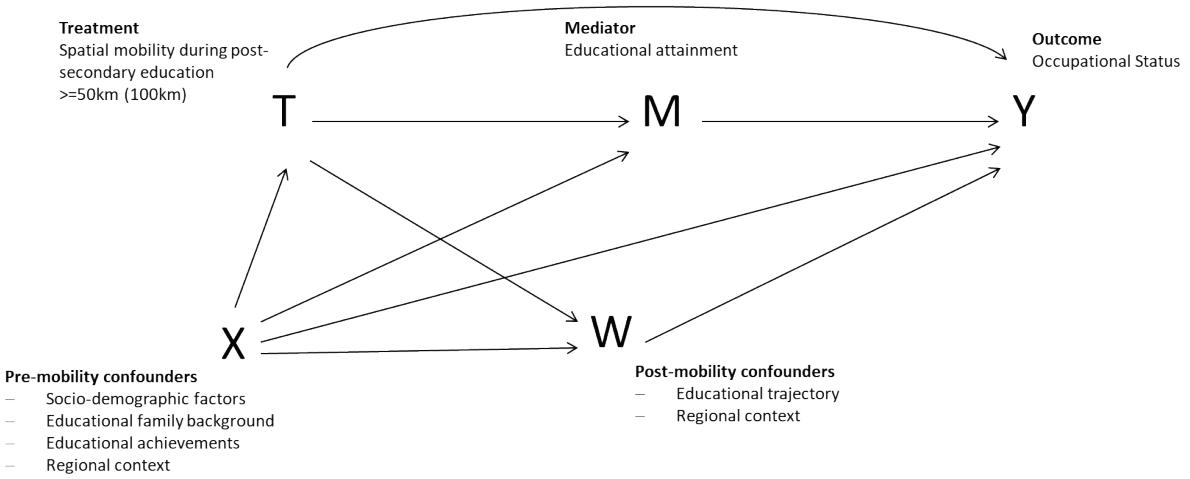
Based on the POF, non-parametric inverse probability weighting (IPW) is applied to mediation analysis (Bodory and Huber, 2018; Huber, 2014). IPW constructs a pseudo population by weighing the mobile and immobile group, respectively, with the inverse of an estimated probability of becoming mobile (propensity scores) based on observed covariates driving selection into mobility. That way, the weighted group is no longer identical to the population actually observed but reflects a potential population in which there was no confounding. Mediation analysis via IPW allows for the unbiased decomposition of the effect of spatial mobility on occupational achievement into a mean indirect effect, which operates through educational achievement (the intermediate or mediator variable) as well as an unmediated mean direct effect. The following overview should give an intuitive understanding of the method and the underlying assumptions, but I recommend Huber (2014) and Bodory and Huber (2018) for a more comprehensive outline.

IPW is suited to analyze mediating pathways, because it does not rely on strong assumptions about the structural linear relationships among the treatment, the mediator, and the outcome. It also allows for selection bias coming from variables influencing both the mediator and the outcome. In the present case, even if selection into spatial mobility is effectively ‘randomized’ given baseline covariates, this does not necessarily hold for the mediator education. IPW, therefore, also assumes mediator exogeneity conditional on observed covariates. Finally, IPW is a non-parametric estimation method which allows for effect heterogeneity, that is, the interaction between the treatment and the mediator in their influence on the outcome (Huber, 2014, p. 923).

The model

Figure 1 presents the model that shall be tested and accounts for the channels through which spatial mobility during post-secondary education may influence occupational outcomes.

Figure 1: Path model of the effect of spatial mobility on occupational status mediated by educational attainment accounting for observed confounders



Note: Model adapted from Huber (2014)

The model shows that education-related spatial mobility (treatment T) may affect occupational status (outcome Y), with educational attainment being an intermediate outcome (mediator M) on the path between T and Y. The path model is sensitive to the sequence/chronology of events and includes contextual as well as personal confounders at the time of their occurrence, i.e. either prior to the treatment (X) determining selection into the spatial mobility, or post-treatment (W), being itself affected by treatment, but driving selection into the mediator.

Importantly, the model controls for confounders (X, W) jointly related with the outcome, the mediator, and/or the treatment allowing for an unbiased decomposition of the direct and indirect effect of spatial mobility given no unobserved confounders. In other words, the treatment and the mediator are exogenous conditional on observed covariates which corresponds to the so called *sequential ignorability assumption* central to effect decomposition via IPW. Two ignorability assumptions are made consecutively. First, given pre-treatment confounders (X) and post-treatment confounders (W), mobility behavior (treatment T) is conditionally independent from potential outcomes (Y) and potential mediator states (M).[5] Second, given treatment as well as pre- and post-treatment confounders, the mediator is conditionally independent from the outcome.[6]

[5] This assumption may be expressed as $\{Y(t',m,w''),M(t,w')\} \perp T | W = w, X = x$ for all $t',t \in \{0,1\}$.

[6] This assumption may be expressed as $Y(t',m,w') \perp M | T = t, W = w, X = x$ for all $t',t \in \{0,1\}$.

For example, assume that family background (such as parents' education) affects spatial mobility as well as the mediator education and the outcome occupational status (for instance via unobserved ability). In addition, the local opportunity structure pre- and post-migration operationalized via district-level population size is influenced by spatial mobility due to common flows of young adults from rural areas into cities (e.g., Milbert and Sturm, 2016), but may itself influence the mediator education, because educational opportunities vary with population size. Therefore, without accounting for migrants' selectivity based on family background as well as population size of the educational district, the decomposition of a direct and an indirect, education-mediated, spatial mobility effect would be biased.

Inverse Probability Weighting

Inverse probability weighting originated from sampling theory where population means are calculated from sampling units drawn from a population based on certain selection probabilities (Horvitz and Thompson, 1952). This technique can also be used to identify treatment effects in observational data and has mostly been applied in the field of economics, for example to study the effect of childbirth on female labor market supply (Fitzenberger *et al.*, 2013). In the present study, IPW first estimates the propensity of being exposed to spatial mobility (the "treatment") based on a probit regression model and then uses the inverse of this probability – the so-called propensity score – as a weight in the subsequent estimation of the direct and indirect effects of spatial mobility on occupational status.

IPW thus creates two groups of individuals that are comparable in their propensity to be selected into a treatment but that differ in realized treatment states (Sampson *et al.*, 2008). In this way, it constructs a pseudo-population of comparison cases. Weighing observations with the *inverse* of the propensity score ensures that larger weights are assigned to cases with a lower probability to be in its realized treatment state, thereby compensating for the underrepresentation of these types of observations in the data. The intuition behind these weights is that respondents from the immobile group with characteristics similar to observations in the mobile group are 'up-weighted' in the analyses, so as to represent their actual contribution to the treatment effect. Inverse-probability weights remove selection into the treatment based on observed covariates resting on the assumption of sequential ignorability.

Effect estimation

Mediation analysis via IPW seeks to quantify the effect of spatial mobility that operates through the mediator education. Here, the direct effect corresponds to the effect of spatial mobility on occupational status by holding the mediator education constant. The direct effect thus indicates the amount by which the occupational status of a spatially mobile person changes in a population where spatial mobility counterfactually generates no impact on education.

Huber (2014) shows that an estimation of the direct effect is numerically identical to the difference between the two propensity-score-weighted mean outcomes and defined for opposite treatment states (t=0 or 1):

$$\theta(t) = E\left[\left(\frac{Y \cdot T}{Pr(T=1|M,W,X)} - \frac{Y \cdot (1-T)}{1-Pr(T=1|M,W,X)}\right) \cdot \frac{Pr(T=t|M,W,X)}{Pr(T=t|X)}\right],\ t \in \{0,1\} \quad (1)$$

Pr(T=1|M, W,X) and Pr(T=1|X) denote the respective estimates of the propensity scores given the covariates and the mediator. In equation (1) the treatment is externally adjusted from T to T-1, while mediator values are held constant at a value implied by T=t. The equation shows the weighting process as well as potential effect heterogeneity depending on whether one compares the treated (t=1) or the untreated (t=0) cases to their respective comparison groups. In case of t=1, the outcome Y of the comparison group is weighted by the inverse of the group's propensity to be in the mobile group,

$$Pr(T = 1|M, W, X)/(1 - Pr(T = 1|M, W, X)).$$

In case of t=0, outcome Y is weighted by the inverse of its propensity to be in the immobile group,

$$(1 - Pr(T = 1|M, W, X))/(Pr(T = 1|M, W, X)).$$

In contrast, the indirect effect corresponds to a change in occupational status if the mediator education changes from the level that would have been realized under spatial mobility to the level that is realized under immobility, while holding the treatment constant. Huber (2014) shows that estimation of the indirect effect is numerically identical to[7]

[7] Strictly speaking, this is only a 'partial' indirect effect. IPW only allows the non-parametric identification of a partial indirect effect, i.e. an effect going from T via M to Y conditional on X, but not operating through the posttreatment confounders, W. The reason is that exogenously adjusting the distribution of M given T=1 to that of M given T=0 conditional on X, while at the same time keeping the distribution of W fixed, is not possible via non-parametric IPW without further assumptions, because W and M are not independent conditional on X. Therefore, the partial indirect effect does not account for the effect of spatial mobility on occupational status that goes through education but takes a devious route through the post-treatment covariates W. In Figure 1 this is represented by the missing arrow from W to M.

$$\delta(t) = E\left[\frac{Y \cdot I\{T=t\}}{Pr(T=t|M,W,X)} \cdot \frac{Pr(T=t|W,X)}{Pr(T=t|X)} \cdot \left(\frac{Pr(T=1|M,W,X)}{Pr(T=1|W,X)} - \frac{1-Pr(T=1|M,W,X)}{1-Pr(T=1|X)}\right)\right],\ t \in \{0,1\} \quad (2)$$

Equation (2) shows that the outcome is held constant at T=t, whereas the inverse probability weights ensure that the mediator values change to the value realized under the respective opposite treatment state considering pre- as well as post-treatment confounders X and W.

Importantly, direct and indirect effects differ depending on the treatment status (1 or 0) generating a direct and an indirect effect for the mobile and the immobile group, respectively. Direct and indirect effects answer the following questions: What would be the effect of the treatment if everyone in the mobile (immobile) group had been exposed to the hypothetical mediator state? What would be the effect of the mediator if everyone had been mobile (immobile)? This allows for interaction between the mediator and the treatment state. Effect heterogeneity will be dealt with in the discussion.

Analyses are implemented with R package *causalweight* for causal inference based on inverse probability weighting (Bodory and Huber, 2018). Bootstrap replications are used to compute standard errors. A trimming rule is applied where observations are discarded with propensity scores smaller than .05 and larger than .95 to exclude extreme cases and to improve the balance between the treatment groups (c.f., Crump *et al.*, 2009).

Data and Variables

Data

Analyses are based on the adult cohort (starting cohort 6, SC6) of the German National Educational Panel Study (NEPS) up to wave nine (Blossfeld *et al.*, 2011). NEPS-SC6 is a nationally representative sample of about 10,000 adult German residents born between 1944 and 1986, interviewed in 2009 for the first time, and followed-up on a yearly basis. NEPS-SC6 provides retrospective and prospective information on respondents complete educational and employment biographies in a spell format. It also includes the location of educational spells at district-level allowing for the reconstruction of spatial educational trajectories as well as an approximation of the distance between educational locations based on the coordinates of district midpoints. The geographical information from educational biographies of earlier cohorts will be adapted to correspond to the current district boundaries.

The data do not allow tracing residential histories, since the place of the educational institution must not coincide with the place of residence. Nevertheless, seizing educational opportunities at distant locations always entails spatial mobility to some degree and it is assumed that larger distances between places of education will likely be accompanied by residential changes. Finally, contextual information can be matched to the data based on district codes.

The analytical sample is restricted to individuals who reported at least one vocational or post-secondary education spell or at least one pre-vocational training year or another vocational preparation. All persons had to be in regular gainful full or part-time employment three years after finishing education. I ensured that persons that were spatially mobile during education and those that were not did not differ with respect to their chances of being employed. The end of education is defined as the point in time when the latest educational spell ends. To keep the sample homogeneous in terms of life-courses following common education-to-work transitions, only educational episodes ending before the age of 36 are considered. As an exception to this rule, later episodes are included if they corresponded to the very first degree the person pursued.

I excluded first and 1.5 generation migrants since their educational trajectories have taken place at least partly abroad and cannot be traced. Persons born in East Germany before 1975 are also excluded, because their spatial mobility behavior during post-secondary education depends on the authoritative structure of a socialist system and was not necessarily an individual choice.[8] The total analytical sample size comprises 5,667 cases.

Variables

Treatment

The binary treatment variable is education-induced spatial mobility taking place over a specified distance after secondary school and during post-secondary education. The operationalization of spatial mobility is based on district-level locational information from education spells. Based on midpoint-coordinates of the districts I calculated the shortest distance between two educational locations (linear distance). Individuals can become spatially mobile either after finishing high school[9], when carrying on with post-secondary education, or when transitioning between post-secondary training spells. I generated two treatment variables with two different cut-offs at which a person counts as spatially mobile, i.e. 50 km and 100 km. Given the relatively high readiness to commute in Germany (Bogai *et al.*, 2008; Kotte and Stöckmann, 2008) it is likely that not all individuals will

[8] I checked that effect estimation is not sensitive to the full exclusion of East Germans from the analyses.

[9] Corresponds in the German system to *Hauptschule, Volksschule, Realschule* or *Gymnasium*

change their place of residence when changing educational locations. Information on the place of residence, which may diverge from the place of education, however, is not available. Nevertheless, I assume these distances – 50 and 100 km, respectively – to be associated with a certain degree of "contextual mobility" (Sharkey and Elwert, 2011), where residential, developmental, social, and family environments change, thus producing an independent spatial mobility effect.

Outcome

Occupational status three years after leaving the educational system is operationalized via the International Socioeconomic Status of Occupation (ISEI) developed by Ganzeboom (2010) with a scale ranging from 11.56 to 88.96. ISEI codes are derived from the International Standard Classification of Occupations (ISCO) 2008[10] and are developed and validated based on data from the International Social Survey Programme (ISSP). A job is assigned a scale value that considers the required level of education as well as its remuneration.

Retrospective information on income trajectories – the most commonly used indicator of migration-related social mobility in previous research – was not available. Yet, occupational status may even be superior to income as an indicator of long-term socio-economic success, because it is unaffected by regional price levels that influence the utility arising from individual earnings (Flippen, 2013, p. 1165).

Mediator

An individual's highest educational attainment is operationalized following the UNESCO's International Standard Classification of Education (ISCED). Based on the German educational system and the distribution of the data, it was reasonable to distinguish four levels: 1 corresponding to ISCED 1-2 (primary/lower secondary education)[11], 2 corresponding to ISCED 3A and ISCED 3B (upper secondary education)[12], 3 corresponding to ISCED 5B and lower level ISCED 5A (practical programs leading to professional qualifications, vocationally oriented higher education institution, and university at Bachelor-level), 4 corresponding to upper-level ISCED 5A and higher (Masters-level-degree at a university and higher).

[10] ISCO is divided into four levels and distinguishes between major (10), sub-major (43), minor (130) and unit groups (435).

[11] Although I only considered cases with at least one post-high school education spell, some respondents do not exceed primary or lower secondary education (ISCED 0-2). This is due to the fact that some respondents either dropped out of training or never went beyond a pre-vocational training year (corresponding to ISCED 2B). However, this applies to only 2 % of the sample (see Table 1).

[12] Includes vocational training beginning around age 15 or 16 as well as completed secondary education in preparation for tertiary education.

Covariates

Following the path model (Figure 1), baseline covariates that determine selection into spatial mobility (pre-treatment) and covariates that are themselves affected by spatial mobility (post-treatment) can be distinguished. Both sets of covariates include characteristics of the person as well as the regional context given the theoretical considerations outlined above concerning migrant selectivity as well as contextual influences. Covariates also include standard socio-demographic control variables.

Pre-treatment

The baseline variables include a dummy for female gender, the year of birth (continuous), a dummy for the presence of children, a dummy for birth in East Germany, a four-level categorical variable for highest educational degree of the parents (see ISCED classification above), a dummy for finishing high school at the highest level preparing for tertiary education (*Abitur*), high school grade point average (GPA) (continuous from .8 (best) to 5 (worst)), a dummy for spatial mobility during early childhood defined as the distance between the districts of two primary or secondary education spells exceeding 50 km, and dummies for field of training (education, humanities, social sciences, natural sciences, information and communication technology, engineering, agriculture, business, health, and services).

On a contextual level, I accounted for the degree of urbanization of the district at the end of secondary education relying on the rural-urban classification of districts of the German Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR): 1 = sparsely populated rural areas, 2 = rural areas with agglomeration tendencies, 3 = urban districts, 4 = autonomous metropolis. In addition, it is taken into consideration whether the district provides for a local university or university of applied sciences[13] as an expression of the general educational opportunity structure. In a decentralized educational system such as Germany's, the availability of institutions of higher education in a district and its degree of urbanization are not necessarily interchangeable (Spiess and Wrohlich, 2010). Higher education institutions may differ considerably in size, with traditional universities providing for currently about 1.8 million students, and one million students currently enrolling in universities of applied sciences. Next to traditional universities and universities of applied sciences, administrative, theological, art, music, and pedagogical colleges also belong to the tertiary level educational structure of more than 400 German higher education institutions (Fritsch and Piontek,

[13] A list of higher education institutions in Germany was provided by the German Rector's Conference (*Hochschulrektorenkonferenz*), historical information on the establishment of district-level higher education institutions was manually researched by the author. Information was subsequently matched to the data based on district codes of educational locations as well as the years of leaving secondary education.

2015). Since their course offer is very limited, they were not factored into the operationalization of the contextual variable.[14]

Post-treatment

Covariates that are themselves influenced by spatial mobility include the duration of total post-secondary education measured in months as well as a dummy for whether a person has started and then discontinued an educational program at least once. The latter possibly relates to "corrective mobility", i.e. students changing educational programs often change educational locations as well (Heinemann and Krawietz, 2008, p. 378). Furthermore, the degree of urbanization of the district at the end of the education is taken into account based on the four-level classification of the BBSR.

Accounting for the local labor market situation would have been desirable. However, a district-level time-series of unemployment rates or business cycles were not available for all periods implied by the present multi-cohort data.

Results

Sample characteristics

Table 1 displays sample means of the outcome (ISEI three years after leaving the training system), all pre-and post-treatment covariates, the mediator (educational attainment), as well as the two versions of the treatment, i.e. spatial mobility during post-secondary education by distance threshold (50 km and 100 km). In the course of their post-secondary education, 34 (23) % of those surveyed where spatially mobile, i.e. visited educational institutions that were at least 50 (100) km apart. About 60 % of the sample have completed education with vocational training on ISCED 3 level, while 40 % have reached a vocationally oriented or academic higher education degree at ISCED 5 level. The mean occupational status is 52 points on the ISEI scale which corresponds to, for example, various groups of government and private sector associate professionals. Furthermore, sample respondents were on average 17.3 years old when finishing high school and on average 23.8 years old when finishing post-secondary education and entering the labor market.

The last four columns of Table 1 contain zero-order correlations between the two treatment indicators, the outcome, the mediator education, and all covariates. As expected, both treatment versions

[14] I checked that the empirical results were not sensitive to their inclusion.

are strongly related to occupational status three years after leaving the educational system (r=.30 (p<=.001) and r=.22 (p<=.001), respectively) as well as to educational attainment (r=.37 (p<=.001) and r=.26 (p<=.001), respectively). Naturally, educational attainment and ISEI are also strongly associated (r=.30, p<=.001), which supports the assumption of socioeconomic returns from spatial mobility operating through education.

In addition, significant correlations between the treatments, the outcome, and the mediator, on the one hand, and the covariates, on the other, indicate that family background, socio-demographic, achievement, and contextual variables are potentially cofounding factors for the complex relationship between spatial mobility, educational attainment, and occupational status. For example, having been educationally mobile during childhood, possibly due to family moves, is associated with higher educational and occupational attainment as well as spatial mobility for post-secondary education. Childhood moves may thus be indicators of familial cultural and social capital and therefore indicators of the selectivity of spatial mobility.

Table 1: Sample means of all variables and correlations with treatment, outcome and mediator

	Mean	Correlation with T_{50km}	Correlation with T_{100km}	Correlation with Y	Correlation with M
Mobility 50km (T_{50km})	.34	1.00			
Mobility 100km (T_{100km})	.23	.75***	1.00		
ISEI 3 years after finishing post-secondary education (Y)	51.83	.30***	.22***	1.00	
Educational attainment (M)		.37***	.26***	.30***	1.00
ISCED 1-2	.02				
ISCED 3A & 3B	.57				
ISCED 5B & 5A excl. university	.23				
ISCED 5A university plus	.18				
Female	.48	-.09***	-.08***	.01	-.14***
Children before education ends	.08	.11***	.11***	-.01	.06***
Birth in East Germany	.05	.06***	.07***	-.03**	-.04**
Year of birth		.03*	.02	.02	-.01
1944-1954	.36				
1955-1964	.25				
1965-1974	.20				
1975-1986	.19				
Parent ISCED		.16***	.13***	.31***	.31***
ISCED 1-2	.14				
ISCED 3A & 3B	.59				
ISCED 5B & 5A excl. university	.14				
ISCED 5A university plus	.13				

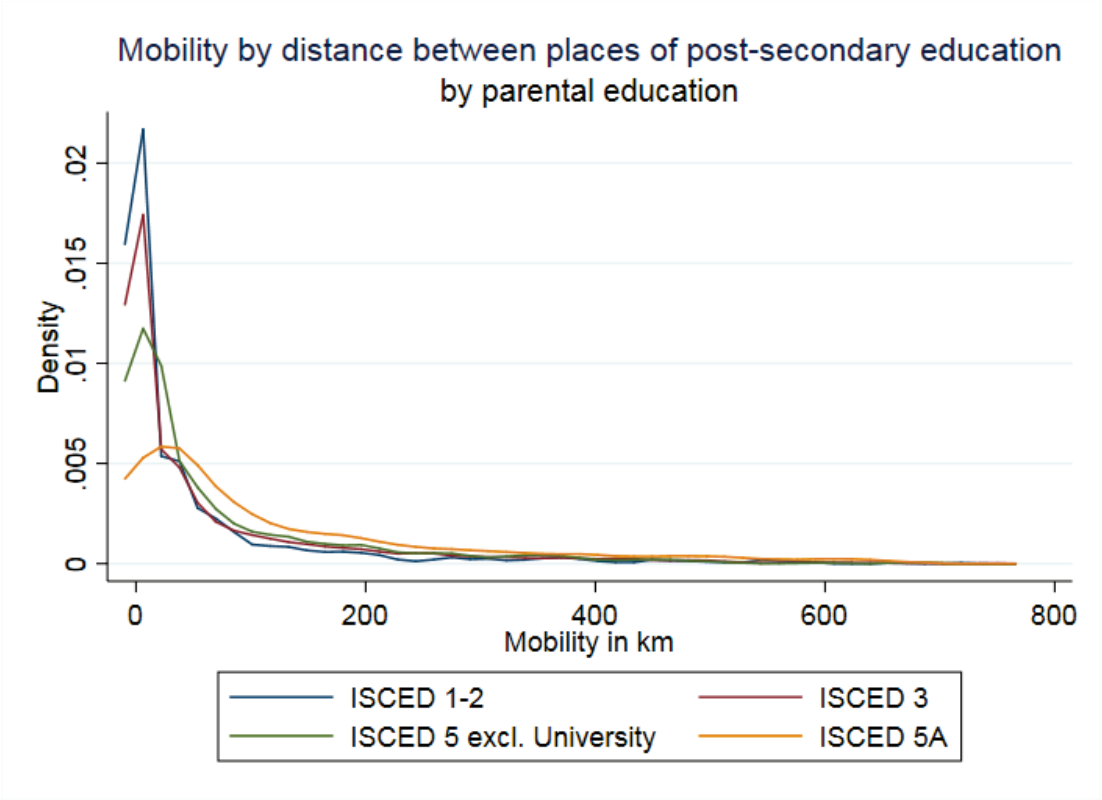
Abitur	.35	.27***	.20***	.56***	.58***
GPA Highschool	2.48	-.14***	-.12***	-.25***	-.22***
Childhood mobility 50km	.09	.13***	.11***	.06***	.06***
Total duration of post-second. education (month)	56.52	.32***	.27***	.43***	.59***
Discontinuation of educational programs	.09	.19***	.16***	.21***	.17***
Field of training					
Education	.08	.13***	.08***	.29***	.38***
Humanities	.06	.11***	.10***	.12***	.14***
Social sciences	.04	.11***	.09***	.18***	.14***
Natural sciences	.03	.09***	.06***	.19***	.22***
Information & communication	.03	.06***	.07***	.12***	.06***
Engineering & production	.32	.02	.02	-.17***	-.03***
Agriculture	.03	.04**	.04**	-.09***	.04**
Business	.26	-.02	.00	.07***	-.07***
Health	.15	.06***	.06***	.16***	.00
Services	.23	-.01	.00	-.24***	-.20***
HEI in district pre-treatment	.46	-.03*	-.01	.10***	.08***
Rural-Urban Structure pre-treatment		-.14***	-.10***	.10***	.06***
Sparsely populated rural area	.14				
Rural area with agglomeration tendency	.18				
Urban district	.39				
Autonomous metropolis	.29				
Rural-Urban Structure post-treatment		.06***	.03*	.23***	.22***
Sparsely populated rural area	.10				
Rural area with agglomeration tendency	.11				
Urban district	.31				
Autonomous metropolis	.48				

Source: NEPS-SC6

N=5,667; p<.10; *p<.05; **p<.01; ***p< .001

Figure 2 plots the density of the distances related to education-induced spatial mobility by parental education. As the graph shows, the lower the educational background of the parents the shorter the distances covered for gaining a post-secondary degree. For example, whereas the median distance that respondents, whose parents lack vocational training, move between educational institutions is 0 km (i.e., no change of district), respondents with university educated parents are much more spatially mobile with a median distance between educational institutions of 57 km.

Figure 2: Spatial Mobility by Distance



Source: NEPS-SC6, N=5,667

Table 2 shows how spatial mobility varies by the rural-urban type of the school district before individuals start post-secondary education. As expected, the more rural the district the larger the distance covered for participating in post-secondary education, underlining the importance of local educational opportunities in triggering spatial mobility.

Table 2: Mobility by distance by rural-urban structure of district at end of secondary education

	Sparsely populated rural area	Rural area w. agglom. tendency	Urban district	Autonomous metropolis	Total
Spatial mobility					
>= 50km	.47	.41	.32	.27	.34
>= 100km	.31	.27	.20	.19	.23

Source: NEPS-SC6, N=5,667

Furthermore, as displayed in Table 3, the distances between educational institutions increase with educational attainment. For example, about 60 percent of individuals who obtain a university degree have been spatially mobile during or when transitioning to post-secondary education for at least 50 km, but only 20 percent of individuals obtaining vocational training on ISCED3-level exceeded that distance. This lends further support to the hypothesis that spatial mobility is an investment in educa-

tional capital and that its effect on occupational status will be at least partly mediated by higher educational attainment of mobile as opposed to nonmobile individuals.

Table 3: Mobility by distance and educational attainment

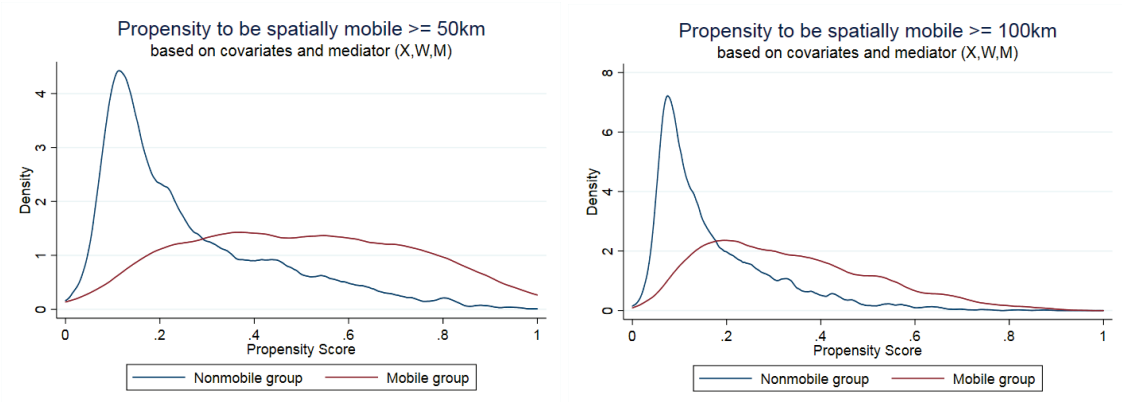
	ISCED 1-2	ISCED 3	ISCED 5 excl. University	ISCED 5+	Total
Spatial mobility					
>= 50km	.13	.20	.52	.61	.34
>= 100km	.07	.14	.34	.40	.23

Source: NEPS, N=5,667

Balancing properties

The two graphs in Figure 3 show the distributions of the estimated propensity scores for the two groups of mobile and nonmobile individuals by means of probit regression of the treatment (for the 50km and 100km threshold-version each) on the covariates and the mediator (X,W,M). The propensity scores of the spatially mobile group are spread more strongly among the higher values of the probability distribution reflecting the selectivity of spatial mobility.

Figure 3 Distribution of Propensity Scores



Source: NEPS-SC6, N=5,667

Since observations are weighed with the inverse of the treatment propensity in order to create balanced comparison groups, the propensity scores should at least partly overlap to calculate the counterfactual values, which they do. In addition, if observations are adequately balanced, the mobile and the nonmobile group should not differ in the distribution of covariates and the mediator, i.e. treatment assignment is ignorable given X, W, and M. IPW is also based on the assumption that there are no unobserved covariates related to occupational status that are also predictive of treatment group assignment once the observed covariates are controlled (see Fn. 3 and 4), but this cannot be tested.

Unfortunately, the *causalweight* R package does not offer a balancing test for inverse probability weighting. Yet, since IPW has much in common with propensity score matching (Morgan and Winship, 2015), I implemented STATA's *psmatch2* and *pstest* commands in order to test whether there was any statistical difference in observed characteristics between the two groups after kernel-based-matching on propensity scores.[15] The balancing test for both versions of the treatment variable (not shown) confirms that all the confounding variables and the mediator are balanced between treatment groups after matching. The bias in the original sample is significantly reduced and no longer significant in the matched sample. [16]

Effect estimation

Table 4 presents the estimated indirect and direct effects for both versions of the treatment along with standard errors and p-values. To check the sensitivity of the results to the inclusion of the pre- and post-treatment confounders X and W, I first estimated models based on socio-demographic control variables only (gender, birth in East Germany, year of birth). In a second step, I included all other confounding factors. As expected, the effect estimates of the reduced model in the upper half of the table including socio-demographic controls only are substantially larger than the full-model estimates in the lower half of the table, confirming the strong influence of confounders. Moreover, in the reduced model, the indirect, education-mediated, effect is two to four times larger than the direct effect, depending on whether one looks at the effects under treatment or non-treatment. It is also evident that, comparing the reduced and the full model, the indirect effect is a lot more sensitive to the inclusion of covariates than the direct effect.

The estimates of the full model suggest that the direct effects under treatment ($\theta(1)_{50km}$=1.85; $\theta(1)_{100km}$=2.73) and non- treatment ($\theta(0)_{50km}$ =3.58; $\theta(0)_{100km}$=3.48) differ in size, yet both are statistically significant. The difference between the effects by treatment status points to effect heterogeneity with respect to treatment state, i.e. effect estimates differ depending on whether we assume that all respondents were in the spatially mobile group or that all respondents were in the nonmobile group. Interpretations of this effect heterogeneity are provided in the discussion.

The indirect effects under treatment ($\delta(1)_{50km}$= 1.13; $\delta(1)_{100km}$= .68) and non-treatment ($\delta(0)_{50km}$= 2.06; $\delta(0)_{100km}$=1.28) are significant, but smaller than the direct effects. Apparently, once accounting for baseline and post-treatment covariates, the education-mediated effect of spatial mobility on occupational status becomes negligible. Overall, one can conclude that for the present sample the

[15] In kernel-based matching, treated observations are matched with a weighted average of all controls, using weights that are inversely proportional to the difference between the propensity scores of treatment and control groups.

[16] Mean bias is calculated for each covariate and is defined as the difference of sample means in the treated and non-treated group after matching divided by the square root of the average sample variances in both groups.

effect of spatial mobility on occupational status three years after leaving education is mediated by educational attainment, but the estimates also show a consistent direct effect of spatial mobility even after accounting for substantial migrant selectivity.

Table 4: IPW-based Estimates of the Direct and Indirect Effects of Spatial Mobility on Occupational Status

	Direct effect mobile $\boldsymbol{\theta(1)}$	Direct effect nonmobile $\boldsymbol{\theta(0)}$	Indirect effect mobile $\boldsymbol{\delta(1)}$	Indirect effect nonmobile $\boldsymbol{\delta(0)}$
Model with pre-treatment socio-demographic controls in X only*				
T = Spatial mobility >=50km				
Treatment effect	1.99	5.37	7.89	11.27
Standard error (boot)	.420	.357	.203	.367
P-Value	.000	.000	.000	.000
T = Spatial mobility >= 100km				
Treatment effect	2.63	5.27	6.01	8.62
Standard error (boot)	.378	.461	461	.630
P-Value	.000	.000	.001	.000
Model with all pre- and post-treatment confounders X and W				
T = Spatial mobility >=50km				
Treatment effect	1.85	3.58	1.13	2.06
Standard error (boot)	.443	.404	.203	.253
P-Value	.000	.000	.000	.000
T = Spatial mobility >= 100km				
Treatment effect	2.73	3.48	.68	1.28
Standard error (boot)	.456	.453	.205	.220
P-Value	.000	.000	.001	.000

Source: NEPS, N=5,667, bootstrapped standard errors each with 100 repetitions
** X include female, birthyear, born in East Germany, presence of children*

Discussion

Building on insights from social mobility research in the tradition of Blau and Duncan (1967) as well as the life-course perspective this study has explored the link between being spatially mobile during post-secondary education and occupational status three years after finishing education, when individuals had time to settle in the labor market. Analyses are based on a representative multicohort sample of German residents that contains complete retrospective and prospective, multidimensional information on individual life-courses. Whereas spatial mobility after leaving high school for further education is a dominant part of the transition to adulthood and accounts for a large proportion of total internal migration dynamics, it has been relatively neglected in studies of social mobility.

The main interest of this study was to identify the mechanisms through which spatial mobility during post-secondary education beyond a distance of at least 50 km may influence occupational outcomes. Starting from a path model, the goal was to identify the average indirect effect of spatial mobility operating though the mediator education, situated on the path between spatial mobility and occupational status, as well as the (unmediated) direct effect. Effects were estimated via inverse probability weighting (IPW) to account for the fact that selection into spatial mobility as well as into the mediator education is non-random and may bias the direct and indirect effect estimates. IPW calculates unbiased direct and indirect effects (if there are no unobserved confounders) by weighing observations by the inverse of their conditional propensity to become mobile given the mediator and observed confounders.

Findings offer support for all initially mentioned explanations for the observed link between education-induced spatial mobility and occupational attainment. First, the mobile population is a highly selective group predestined towards career success from the start, possibly because they are already achievement-oriented or had pro-educational family environments. Second, spatial mobility relates to contextual opportunities that may themselves improve the chances for social mobility since moves to more populated areas increase the chances for occupational mobility. Third, migration may simply fulfil the purpose of reaching higher educational levels without having an effect of its own. And finally, spatial mobility may have an independent impact on occupational mobility, e.g. through being an unparalleled learning experience during the transition towards adulthood or because individuals overcome restraining social and geographical environments.

In more technical terms, the empirical results reveal that there is a strong correlation between education-induced spatial mobility and occupational status. The major part of this link can be explained by confounding factors that influence spatial mobility as well as educational and occupational attainment. In agreement with previous studies, selectivity factors include personal characteristics like a conducive family educational environment as well as pre-mobility educational achievements like better high school grade point average and obtaining the highest secondary school degree (*Abitur*). Moreover, being exposed to regional opportunities, approximated via population size of the district when starting and finishing post-secondary education, is coupled with spatial mobility as well as educational and occupational achievements, and will therefore be responsible for part of the link between social and spatial mobility.

Despite these confounding influences, the empirical results consistently show a significant direct effect of spatial mobility on occupational attainment of about 2 to 3 points on the ISEI scale, corresponding for example in the legal professions to the difference between lawyers and judges, or in the health professions to the differences between nurses and nursing associate professionals. Following

the life-course perspective, it may therefore be the case that "decisions concerning staying in, or leaving, the home community after high school carry fateful significance […]: A decision to migrate may have momentous potential consequences for subsequent occupational trajectory" (Rieger, 1972, p. 205). Yet, one can only speculate as to what specific dynamics will eventually explain the direct effect of spatial mobility on occupational status. It could be experiential learning as well as some other mechanism this study could not account for. The empirical results also indicate that the indirect effect of spatial mobility via educational attainment becomes negligible once accounting for self-selection into mobility and education. Apparently, advanced educational attainment is less of a mediator in the relationship between spatial mobility and occupational attainment and more of an indicator of the strong selectivity of spatial mobility given base-line covariates such as family background and previous achievement factors. In other words, spatial mobility after leaving high school as well as the pursual of advanced educational degrees is the result of the same underlying characteristics of the mobile group and selection processes.

Moreover, the direct effects under treatment and nontreatment differ in size, indicating effect heterogeneity. Thus, spatial mobility during post-secondary education contributes more to reaching higher occupational positions for individuals in the nonmobile group (compared to a counterfactual scenario where they had been mobile) than for those in the mobile group (compared to a counterfactual scenario where they were not mobile), excluding the part of the effect that operates through higher educational achievements. Therefore, while contemporary public and scholarly debates focus on education as the predominant mechanism of social advancement (Ferrie, 2005), spatial mobility may indeed fulfil a complementary role in social mobility. In addition, spatial mobility seems to be potentially most valuable for those in the least mobile group and with the least favorable starting conditions for social mobility. This aligns with observations by Fielding (1989, p. 69) that "those who need to migrate the least […] migrate the most, while those who need to migrate the most […] migrate the least" (for a similar argument, see Savage, 1988). It also puts into perspective views about spatial mobility as a potential exacerbator of social inequalities (e.g., Viry *et al.*, 2010). Although spatial mobility is selectively practiced by higher status groups, it does not necessarily extend their positional lead in social and occupational hierarchies.

Even so, substantial effect heterogeneity is not the only possible explanation of why the direct effect of spatial mobility may not be homogeneous across the study population. It is also possible that self-selection into spatial mobility based on unobserved factors (e.g. ability, career orientation, and motivation) are more meaningful for persons with a low propensity to become mobile. For example, those overcoming distance barriers despite financial and social constrains may be a particularly motivated group. Economists call this "sorting gain selection" (c.f., Tsai, 2015). In that case, it would

not be possible to identify unbiased direct effects based on observed characteristics of the person only.

That said, attending to both observed and unobserved confounding will make an important contribution to future research, especially if policy implications are to be drawn with regard to fostering spatial mobility among young people and overcoming distance barriers. A further limitation of this study is that the local economic situation related to spatial mobility and labor market success is insufficiently taken into account due to data restrictions. Moreover, pooling data over multiple cohorts may mask the changing importance of spatial mobility in the biographies of young people. The sample is also heterogeneous in terms of educational trajectories that individuals follow (tertiary and non-tertiary qualifications) and analyses may not be able to uncover training-specific social and spatial mobility dynamics.

This study thus offers only initial evidence that taking advantage of educational opportunities at distant locations may be beneficial to the social mobility of young people beyond educational advancement, especially for those with disadvantageous starting positions. Future work on links between social and spatial mobility should not only attend to the selectivity of spatial mobility based on unobserved confounding. It could also follow up on potential heterogeneity in the returns to spatial mobility across the population and may be particularly informative for finding the right beneficiaries of potential educational policy interventions.

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References

Abraham, M. and N Nisic (2012), "A simple mobility game for couples' migration decisions and some quasi-experimental evidence", *Rationality and Society*, **24** (2), 168–197.

Alm, J. and J V. Winters (2009), "Distance and intrastate college student migration", *Economics of Education Review*, **28** (6), 728–738.

Beck, Ulrich, Anthony Giddens and Scott Lash (1994), *Reflexive modernization: Politics, tradition and aesthetics in the modern social order*: Stanford, CA, Stanford University Press.

Bernard, A., M Bell and E Charles-Edwards (2016), "Internal migration age patterns and the transition to adulthood. Australia and Great Britain compared", *Journal of Population Research*, **33** (2), 123–146.

Bernard, A., M Bell and E Charles-Edwards (2014), "Life-course transitions and the age profile of internal migration", *Population and Development Review*, **40** (2), 213–239.

BIBB (2015), *Datenreport zum Berufsbildungsbericht 2015: Informationen und Analysen zur Entwicklung der beruflichen Bildung*: Bonn.

BIBB (2018), *Datenreport zum Berufsbildungsbericht 2018: Informationen und Analysen zur Entwicklung der berufl ichen BildungBundesinstitut*: Bonn.

Blau, Peter M. and Otis D. Duncan (1967), *The American occupational structure*: New York, NY, John Wiley & Sons, Ltd.

Blossfeld, Hans-Peter, Roßbach, Hans-Günther and Maurice, Jutta v. (eds) (2011), *Education as a lifelong process: The German National Educational Panel Study (NEPS)*, Supplement 2, Vol. 14.

Bodory, Hugo and Martin Huber (2018), *The causalweight package for causal inference in R*.

Bogai, D., H Seibert and D Wiethölter (2008), "Duale Ausbildung in Deutschland. Die Suche nach Lehrstellen macht junge Menschen mobil", *IAB-Kurzbericht*, **9** .

Borjas, G.J. (1987), "Self-Selection and the Earnings of Immigrants", *American Economic Review*, **77** (4), 531–553.

Börsch-Supan, A. (1990), "Education and its double-edged impact on mobility", *Economics of Education Review*, **9** (1), 39–53.

Bowles, S. (1970), "Migration as investment. Empirical tests of the human investment approach to geographical mobility", *The Review of Economics and Statistics* 356–362.

Cebula, R.J. (2005), "Internal migration determinants. Recent evidence", *International Advances in Economic Research*, **11** (3), 267–274.

Christie, H. (2007), "Higher education and spatial (im) mobility. Nontraditional students and living at home", *Environment and Planning A*, **39** (10), 2445–2463.

Cicognani, E., I Menezes and G Nata (2011), "University students' sense of belonging to the home town. The role of residential mobility", *Social Indicators Research*, **104** (1), 33–45.

Cobb-Clark, D.A. (1993), "Immigrant Selectivity and Wages. The Evidence for Women", *The American Economic Review*, **83** (4), 986–993.

Cooke, T.J. (2011), "It is not just the economy. Declining migration and the rise of secular rootedness", *Population, Space and Place*, **17** (3), 193–203.

Cooke, T.J. and A J. Bailey (1996), "Family Migration and the Employment of Married Women and Men", *Economic Geography*, **72** (1), 38–48.

Cooke, T.J. and P Boyle (2011), "The migration of high school graduates to college", *Educational Evaluation and Policy Analysis*, **33** (2), 202–213.

Coulter, R., M van Ham and A M. Findlay (2016), "Re-thinking residential mobility. Linking lives through time and space", *Progress in Human Geography*, **40** (3), 352–374.

Crump, R.K., V J. Hotz, G W. Imbens and O A. Mitnik (2009), "Dealing with limited overlap in estimation of average treatment effects", *Biometrika*, **96** (1), 187–199.

DaVanzo, J. (1981), "Repeat migration, information costs, and location-specific capital", *Population and environment*, **4** (1), 45–73.

Denzler, Stefan and Stefan C. Wolter (2010), *Wenn das Nächstgelegene die erste Wahl ist. Der Einfluss der geographischen Mobilität der Studierenden auf die Hochschullandschaft Schweiz*, SKBF.

Dionisius, Regina and Amelie Illiger (2015), *Trends ins Studium und in die duale Berufsausbildung unter Berücksichtigung ausgewählter Einflussfaktoren, Wissenschaftliche Diskussionspapiere*: Bonn.

Durrer, F. and C Heine (1996), "Studienaufnahme und regionale Mobilität. Eine länderbezogene Analyse der Hochschulwahl der Studienberechtigten 90, 92 und 94", *HIS Kurzinformation*, **A 10** .

Elder, G.H., V King and R D. Conger (1995), "Attachment to place and migration prospects. A developmental perspective", *Journal of Research on Adolescence*, **6** (4), 397–425.

Ellis, E. (1952), "Social psychological correlates of upward social mobility among unmarried career women", *American Sociological Review*, **17** (5), 558–563.

El-Mafaalani, Aladin (2012), *BildungsaufsteigerInnen aus benachteiligten Milieus: Habitustransformation und soziale Mobilität bei Einheimischen und Türkeistämmigen*: Wiesbaden, Springer VS.

Evans, C. (2016), "Moving away or staying local. The role of locality in young people's 'spatial horizons' and career aspirations", *Journal of Youth Studies*, **19** (4), 501–516.

Faggian, A. and R S. Franklin (2014), "Human capital redistribution in the USA. The migration of the college-bound", *Spatial Economic Analysis*, **9** (4), 376–395.

Faggian, A. and P McCann (2009), "Universities, agglomerations and graduate human capital mobility", *Tijdschrift voor economische en sociale geografie*, **100** (2), 210–223.

Ferrie, J.P. (2005), "History Lessons. The End of American Exceptionalism? Mobility in the United States Since 1850", *Journal of Economic Perspectives*, **19** (3), 199–215.

Fielding, A. and S Halford (1993), "Geographies of opportunity. A regional analysis of gender-specific social and spatial mobilities in England and Wales, 1971–81", *Environment and Planning A*, **25** (10), 1421–1440.

Fielding, A.J. (1989), "Migration and urbanization in Western Europe since 1950", *The Geographical Journal*, **155** (1), 60–69.

Fielding, A.J. (1992), "Migration and social mobility. South East England as an escalator region", *Regional Studies*, **26** (1), 1–15.

Fitzenberger, B., K Sommerfeld and S Steffes (2013), "Causal effects on employment after first birth—A dynamic treatment approach", *Labour Economics*, **25** 49–62.

Flannery, D. and J Cullinan (2014), "Where they go, what they do and why it matters. The importance of geographic accessibility and social class for decisions relating to higher education institution type, degree level and field of study", *Applied Economics*, **46** (24), 2952–2965.

Flippen, C. (2013), "Relative Deprivation and Internal Migration in the United States. A Comparison of Black and White Men", *American Journal of Sociology*, **118** (5), 1161–1198.

Frenette, M. (2006), "Too far to go on? Distance to school and university participation", *Education Economics*, **14** (1), 31–58.

Freytag, T. and H Jahnke (2015), "Perspektiven für eine konzeptionelle Orientierung der Bildungsgeographie", *Geographica Helvetica*, **70** (1), 75–88.

Fritsch, M. and M Piontek (2015), "Die Hochschullandschaft im demographischen Wandel–Entwicklungstrends und Handlungsalternativen", *Raumforschung und Raumordnung*, **73** (5), 357–368.

Frohwieser, Dana (2002), "Der demographische Wandel in Sachsen und dessen voraussichtliche Konsequenzen für die Entwicklung der Studiennachfrage an den sächsischen Hochschulen", Diplomprüfung in Erziehungswissenschaft, Technischen Universität Dresden, 2002.

Fuller, S. (2008), "Job mobility and wage trajectories for men and women in the United States", *American Sociological Review*, **73** (1), 158–183.

Gabriel, P.E. and S Schmitz (1995), "Favorable Self-Selection and the Internal Migration of Young White Males in the United States", *The Journal of Human Resources*, **30** (3), 460–471.

Garza, A.N. and A S. Fullerton (2018), "Staying Close or Going Away. How Distance to College Impacts the Educational Attainment and Academic Performance of First-generation College Students", *Sociological Perspectives*, **61** (1), 164–185.

Geist, C. and P A. McManus (2008), "Geographical mobility over the life course. Motivations and implications", *Population, Space and Place*, **14** (4), 283–303.

Gibbs, R.M. (1995), "Going away to college and wider urban job opportunities take highly educated youth away from rural areas", *Rural Development Perspectives*, **10** (3), 35–44.

Goodwin-White, J. (2016), "Is Social Mobility Spatial? Characteristics of Immigrant Metros and Second Generation Outcomes. 1940–1970 and 1970–2000", *Population, Space and Place*, **22** (8), 807–822.

Greenwood, M.J. (1975), "Research on internal migration in the United States. A survey", *Journal of Economic Literature*, **13** (2), 397–433.

Greenwood, M.J. (1997), "Chapter 12 Internal migration in developed countries", in Mark R. Rosenzweig and Oded Stark (eds), *Handbook of Population and Family Economics*, Vol. 1, Amsterdam: Elsevier, pp. 647–720.

Haapanen, M. and H Tervo (2012), "Migration of the highly educated: Evidence from residence spells of university graduates", *Journal of Regional Science*, **52** (4), 587–605.

Hacket, Anne (2009), *Lohnt sich Mobilität: Einkommensperspektiven in internen und externen Arbeitsmärkten in den ersten Berufsjahren*: Wiesbaden, Springer VS.

Hagan, J., R MacMillan and B Wheaton (1996), "New Kid in Town. Social Capital and the Life Course Effects of Family Migration on Children", *American Sociological Review*, **61** (3), 368–385.

Harten, Uwe (2013), *Betriebliche Ausbildung und Mobilität von Auszubildenden in Niedersachsen-Bremen, IAB-Regional. IAB Niedersachsen-Bremen,* Nürnberg.

Heinemann, M. and M Krawietz (2008), "Mobilität und Studium", *Bildung und Erziehung*, **61** (4), 377–386.

Helbig, M., J Jähnen and A Marczuk (2017), "Eine Frage des Wohnorts. Zur Bedeutung der räumlichen Nähe von Hochschulen für die Studienentscheidung in Deutschland", [Does Place of Residence Matter? How the Geographical Proximity of Universities Affects Enrollment in Higher Education in Germany], *Zeitschrift für Soziologie*, **46** (1), 55–70.

Holdsworth, C. (2009), "`Going away to uni': mobility, modernity, and independence of English higher education students", *Environment and Planning A*, **41** (8), 1849–1864.

Horvitz, D.G. and D J. Thompson (1952), "A generalization of sampling without replacement from a finite universe", *Journal of the American Statistical Association*, **47** (260), 663–685.

Howell, F.M. (1981), "Residential Preferences and Life Plans", *Youth & Society*, **12** (3), 351–377.

Huber, M. (2014), "Identifying causal mechanisms (primarily) based on inverse probability weighting", *Journal of Applied Econometrics*, **29** (6), 920–943.

Jobstarter Regional (2015), *Auf zu neuen Ufern! Mobilität in der dualen Ausbildung,* Ausgabe 1: Bonn.

Johnson, J.H. and J Salt (1980), "Labour migration within organizations. An introductory study", *Tijdschrift Voor Economische En Sociale Geografie/Journal of Economic and Social Geography*, **71** (5), 277–284.

Jost, O., H Seibert and D Wiethölter (2019), "Regionale Mobilität von Lehrlingen. Auszubildende in MINT-Berufen pendeln besonders häufig", *IAB-Kurzbericht*, **2** .

Kaufmann, V. (2014), "Mobility as a Tool for Sociology", *Sociologica*, **8** (1), 1–17.

Kaufmann, V., M M. Bergman and D Joye (2004), "Motility: mobility as capital", *International Journal of Urban and Regional Research*, **28** (4), 745–756.

Kesselring, S. (2008), "The mobile risk society", in Weert Canzler, Vincent Kaufmann and Sven Kesselring (eds), *Tracing mobilities: Towards a cosmopolitan perspective*, Aldershot: Ashgate Publishing, Ltd, pp. 77–102.

Kirkpatrick Johnson, M., G H. Elder Jr. and M Stern (2005), "Attachments to Family and Community and the Young Adult Transition of Rural Youth", *Journal of Research on Adolescence*, **15** (1), 99–125.

Kley, S. (2016), "Regionale Mobilität in der Bevölkerungssoziologie", in Yasemin Niephaus, Michaela Kreyenfeld and Reinhold Sackmann (eds), *Handbuch Bevöllerungssoziologie*, Wiesbaden: Springer VS, pp. 481–500.

Kley, S.A. and C H. Mulder (2010), "Considering, planning, and realizing migration in early adulthood. The influence of life-course events and perceived opportunities on leaving the city in Germany", *Journal of housing and the built environment*, **25** (1), 73–94.

KMK (2002), "Die Mobilität der Studienanfänger und Studierenden in Deutschland von 1980 bis 2000", *Statistische Veröffentlichungen der Kultusministerkonferenz*, **160** (März).

KMK (2007), "Die Mobilität der Studienanfänger und Studierenden in Deutschland von 1980 bis 2005", *Statistische Veröffentlichungen der Kultusministerkonferenz*, **183** (August).

KMK (2014), "Die Mobilität der Studienanfänger und Studierenden in Deutschland von 1992 bis 2012", *Statistische Veröffentlichungen der Kultusministerkonferenz*, **203** (Juli).

Kosmützky, A. and A Ewen (2016), "Chapter 9: Global, national and local? The multilayered spatial ties of universities to society", in David M. Hoffmann and Jussi Välimaa (eds), *Be-Coming Universities?: Higher Education Institutions in Networked Knowledge Societies*, Dordrecht: Springer Science + Business Media, pp. 223–245.

Kotte, Volker and Andrea Stöckmann (2008), *Ausbildungsmobilität in Schleswig-Holstein, IAB-Regional. IAB Nord*: Nürnberg.

Krawietz, M. (2008), "Studentische Mobilität in Deutschland - Der Einfluss der Neuen Studiengänge Bachelor und Master", *Bildung und Erziehung*, **61** (4), 387–411.

Kröhnert, S. and S Vollmer (2012), "Gender-Specific Migration from Eastern to Western Germany. Where Have All the Young Women Gone?", *International Migration*, **50** (5), 95–112.

Kubis, A. and L Schneider (2009), "Im Fokus. Ist Abwanderung typisch ostdeutsch? Regionale Mobilität im West-Ost-Vergleich", *Wirtschaft im Wandel*, **15** (4), 152–157.

Kubis, Alexander and Lutz Schneider (2007), *Determinants of Female Migration The Case of German NUTS 3 Regions*, IWH Discussion Papers: Halle (Saale), Leibniz-Institut für Wirtschaftsforschung Halle (IWH).

Lawton, L., M Silverstein and V Bengtson (1994), "Affection, social contact, and geographic distance between adult children and their parents", *Journal of Marriage and the Family*, **56** (1), 57–68.

Leopold, T., F Geissler and S Pink (2012), "How far do children move? Spatial distances after leaving the parental home", *Social Science Research*, **41** (4), 991–1002.

Lindgren, J. and L Lundahl (2010), "Mobilities of Youth. Social and Spatial Trajectories in a Segregated Sweden", *European Educational Research Journal*, **9** (2), 192–207.

Lörz, M. (2008), "Räumliche Mobilität beim Übergang ins Studium und im Studienverlauf. Herkunftsspeziifische Unterschiede in der Wahl und Nachhaltigkeit des Studienortes", *Bildung und Erziehung*, **61** (4), 413–436.

Lui, C.K., P J. Chung, S P. Wallace and C S. Aneshensel (2014), "Social status attainment during the transition to adulthood", *Journal of youth and adolescence*, **43** (7), 1134–1150.

Malke, A., K Persich, S Persich and K Seifert (2010), "Ungleiches Allgemeinwissen. Eine Analyse sozialer Unterschiede anhand der Entfernung von Hochschule und Heimatort", in Sabine Trepte and Markus Verbeet (eds), *Allgemeinbildung in Deutschland: Erkenntnisse aus dem SPIEGEL-Studentenpisa-Test*, Wiesbaden: Springer VS, pp. 195–206.

McClelland, R.J. and R J. Gandy (2012), "Undergraduate regional migration in the UK. Perspectives on local markets and trends for gender and international student groups", *Studies in Higher Education*, **37** (8), 901–924.

Meusburger, P. (2008), "Arbeitsplatzangebot, Bildungsverhalten und Mobilität von Hochqualifizierten", *forum ifl*, **8** (Brain drain oder brain circulation? Konsequenzen und Perspektiven der Ost-West-Migration), 31–42.

Milbert, A. and G Sturm (2016), "Binnenwanderungen in Deutschland zwischen 1975 und 2013", *Informationen zur Raumentwicklung* (2), 121–144.

Molloy, R., C L. Smith and A Wozniak (2017), "Job changing and the decline in long-distance migration in the United States", *Demography*, **54** (2), 631–653.

Morgan, Stephen L. and Christopher Winship (2015), *Counterfactuals and Causal Inference: Methods and Principles for Social Research*, Cambridge University Press: New York, NY.

Mulder, C.H. and M van Ham (2005), "Migration histories and occupational achievement", *Population, Space and Place*, **11** (3), 173–186.

Nutz, M. (2004), "Auswirkungen der Bevölkerungsentwicklung auf das Hochschulwesen", in Statistisches Bundesamt (ed), *Demographischer Wandel – Auswirkungen auf das Bildungssystem: Beiträge zum wissenschaftlichen Kolloquium am 18. und 19. November 2004 in Wiesbaden*, Wiesbaden: Statisches Bundesamt, pp. 45–52.

Partridge, M.D., D S. Rickman, M R. Olfert and K Ali (2012), "Dwindling US internal migration. Evidence of spatial equilibrium or structural shifts in local labor markets?", *Regional Science and Urban Economics*, **42** (1-2), 375–388.

Patiniotis, J. and C Holdsworth (2005), "'Seize that chance!'Leaving home and transitions to higher education", *Journal of Youth Studies*, **8** (1), 81–95.

Puhani, P.A. (2001), "Labour mobility. An adjustment mechanism in Euroland? Empirical evidence for Western Germany, France and Italy", *German Economic Review*, **2** (2), 127–140.

Reichelt, M. and M Abraham (2017), "Occupational and regional mobility as substitutes. A new approach to understanding job changes and wage inequality", *Social Forces*, **95** (4), 1399–1426.

Reimer, D. (2013), "Kontexteffekte und soziale Ungleichheit beim Übergang von der Schule zur Hochschule", in Rolf Becker and Alexander Schulze (eds), *Bildungskontexte*, Wiesbaden: Springer VS, pp. 405–429.

Rieger, J.H. (1972), "GEOGRAPHIC MOBILITY AND THE OCCUPATIONAL ATTAINMENT OF RURAL YOUTH. A LONGITUDINAL EVALUATION", *Rural Sociology*, **37** (2), 189–207.

Riew, J. (1973), "Migration as investment", *Journal of Regional Science*, **12** (2), 65–73.

Ritchey, P.N. (1976), "Explanations of Migration", *Annual Review of Sociology*, **2** 363–404.

Rubin, D.B. (2005), "Causal Inference Using Potential Outcomes", *Journal of the American Statistical Association*, **100** (469), 322–331.

Rye, J.F. (2006), "Leaving the countryside. An analysis of rural-to-urban migration and long-term capital accumulation", *Acta Sociologica*, **49** (1), 47–65.

Sabot, R.H. (1987), "Internal migration and education", in George Psacharopoulos (ed), *Economics of Education: Research and Studies*, Amsterdam: Elsevier, pp. 196–198.

Sampson, R.J. and J H. Laub (1996), "Socioeconomic Achievement in the Life Course of Disadvantaged Men. Military Service as a Turning Point, Circa 1940-1965", *American Sociological Review*, **61** (3), 347–367.

Sampson, R.J., P Sharkey and S W. Raudenbush (2008), "Durable effects of concentrated disadvantage on verbal ability among African-American children", *Proceedings of the National Academy of Sciences*, **105** (3), 845–852.

Sandefur, G.D. and W J. Scott (1981), "A dynamic analysis of migration. An assessment of the effects of age, family and career variables", *Demography*, **18** (3), 355–368.

Sander, N. (2014), "Internal Migration in Germany, 1995-2010. New Insights into East-West Migration and Re-urbanisation", *Comparative Population Studies*, **39** (2), 217–246.

Sander, N. (2018), "Germany. Internal migration within a changing nation", in Tony Champion, Thomas J. Cooke and Ian Shuttleworth (eds), *Internal Migration in the Developed World: Are We Becoming Less Mobile?*, Abingdon, Oxon: Routledge, pp. 226–241.

Sander, N. and M Bell (2016), "Age, period, and cohort effects on migration of the baby boomers in Australia", *Population, Space and Place*, **22** (6), 617–630.

Savage, M. (1988), "The Missing Link? The Relationship between Spatial Mobility and Social Mobility", *The British Journal of Sociology*, **39** (4), 554–577.

Schultz, T.W. (1961), "Investment in Human Capital", *The American Economic Review*, **51** (1), 1–17.

Seibert, Holger, Jeanette Carstensen and Doris Wiethölter (2018), *Ausbildungsmobilität in Berlin-Brandenburg: Soziodemografische Merkmale im Jahr 2016, IAB-Regional. IAB Berlin-Brandenburg*: Nürnberg.

Sellar, S. and T Gale (2011), "Mobility, aspiration, voice. A new structure of feeling for student equity in higher education", *Critical studies in education*, **52** (2), 115–134.

Sharkey, P. and F Elwert (2011), "The legacy of disadvantage. Multigenerational neighborhood effects on cognitive ability", *American Journal of Sociology*, **116** (6), 1934–1981.

Shelton, N. and E Grundy (2000), "Proximity of adult children to their parents in Great Britain", *International Journal of Population Geography*, **6** (3), 181–195.

Shryock, H.S., JR. and C B. Nam (1965), "Educational Selectivity of Interregional Migration*", *Social Forces*, **43** (3), 299–310.

Sjaastad, L.A. (1962), "The costs and returns of human migration", *Journal of political Economy*, **70** (5, Part 2), 80–93.

Smith, D.P. and H Jöns (2015), "Education and internal migration", in Darren P. Smith, Nissa Finney, Keith Halfacree and Nigel Walford (eds), *Internal Migration: Geographical Perspectives and Processes*, *International Population Studies*, London: Routledge, pp. 47–63.

Smits, J. (2001), "Career migration, self-selection and the earnings of married men and women in the Netherlands, 1981-93", *Urban Studies*, **38** (3), 541–562.

Spiess, C.K. and K Wrohlich (2010), "Does distance determine who attends a university in Germany?", *Economics of Education Review*, **29** (3), 470–479.

Stouffer, S.A. (1940), "Intervening opportunities. A theory relating mobility and distance", *American Sociological Review*, **5** (6), 845–867.

Swanson, C.B. and B Schneider (1999), "Students on the move. Residential and educational mobility in America's schools", *Sociology of Education*, **72** (1), 54–67.

Tindal, S., H Packwood, A Findlay, S Leahy and D McCollum (2015), "In what sense 'distinctive'? The search for distinction amongst cross-border student migrants in the UK", *Geoforum*, **64** (August), 90–99.

Tsai, S.-L. (2015), "Revisiting Selection in Heterogeneous Returns to College Education", *Journal of Social Sciences and Philosophy*, **27** (2), 323–360.

Turley López, R.N. (2009), "College proximity. Mapping access to opportunity", *Sociology of Education*, **82** (2), 126–146.

Viry, G., H Hofmeister and E Widmer (2010), “Early life course relocation. Effects on motility, mobility and social integration”, in Norbert F. Schneider and Beate Collet (eds), *Mobile living across Europe II: Causes and consequences of job-related spatial mobility in cross-national comparison*, Opladen: Barbara Budrich, pp. 153–172.

Viry, G., H Rüger and T Skora (2014), “Migration and long-distance commuting histories and their links to career achievement in Germany. A sequence analysis”, *Sociological research online*, **19** (1), 1–15.

Wagner, M. (1990), “Regionale Herkunft und Lebensverlauf”, in Lothar Bertels and Herlyn Ulfert (eds), *Lebenslauf und Raumerfahrung*, Wiesbaden: VS Verlag für Sozialwissenschaften, pp. 123–143.

Walker, C. (2010), “Space, Kinship Networks and Youth Transition in Provincial Russia. Negotiating Urban–Rural and Inter-Regional Migration”, *Europe-Asia Studies*, **62** (4), 647–669.

Wiethölter, Doris, Holger Seibert and Dieter Bogai (2007), *Ausbildungsmobilität in der Region Berlin-Brandenburg, IAB-Regional. IAB Berlin-Brandenburg*: Nürnberg.

Wilson, F.D. (1985), “Migration and Occupational Mobility. A Research Note”, *International Migration Review*, **19** (2), 278–292.

Wilson, Franklin D. and Marta Tienda (1988), *Ethnicity, Employment and Migration, ISSR Working Papers in the Social Sciences*, Vol. 4: Los Angeles, CA.

Yankow, J.J. (1999), “The wage dynamics of internal migration within the United States”, *Eastern Economic Journal*, **25** (3), 265–278.

Yankow, J.J. (2003), “Migration, job change, and wage growth. A new perspective on the pecuniary return to geographic mobility”, *Journal of Regional Science*, **43** (3), 483–516.

Zipf, G.K. (1947), “The Hypothesis of the `Minimum Equation' as a Unifying Social Principle. With Attempted Synthesis”, *American Sociological Review*, **12** (6), 627–650.