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Educational Mismatch and Mobility

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Abstract

With increasing educational attainment in Germany, the issue of inefficient human capital allocation gains importance. Especially overeducation seems to be a problem, since more and more highly educated individuals are required to take jobs that do not match their educational level, settling for lower wages than their peers. This raises the question, how these individuals perform in these jobs and whether they have an advantage compared to their adequately educated colleagues performing the same job. The career mobility model suggests that this is indeed the case, with overeducated workers being more prone to take up on-the-job training, to climb up the career ladder, or to eventually leave to professions more suitable to their educational level. Our empirical analysis, using the German SOEP, confirms this theory for Germany. We find that overeducated workers have a significantly higher probability to take up on-the-job training than adequately educated workers and, at least in certain jobs, have a higher probability to move to jobs that better match their educational level. Furthermore, we find that overeducated workers experience higher wage growth than their colleagues in all job types.

JEL Classification: I26, J24, J31

Keywords: Education; educational mismatch; wages; job mobility; training

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1 Christiane Roller, RUB; Christian Rulff, RUB and RWI; Michael M. Tamminga, RUB and RWI. *– The authors are grateful to Thomas Bauer, Julia Bredtmann, Sebastian Otten, and Stella Martin for helpful comments and suggestions. All remaining errors are our own.* *– All correspondence to: Christian Rulff, Ruhr University Bochum, Chair of Empirical Economics, Universitätsstr. 150, 44801 Bochum, Germany, e-mail: christian.rulff@rub.de*

1 Introduction

Overeducation, the situation in which an employee works in a position with educational requirements below his or her formal qualification, is a common phenomenon in industrialized countries. Especially in Germany, with increasing educational attainment and simultaneous high labor demand, the issue of overeducation is prevalent in the public discussion as well as in the scientific community. Most frequently, the debate is focused on individuals' adverse labor market outcomes despite their high levels of education. The famous proverbial fate of graduates in the humanities being destined for a career as a taxi driver further highlights the awareness of the public when it comes to educational mismatch. Meanwhile, its origins remain not yet finally explained.

The most common explanation on why overeducation occurs is provided by the career mobility theory first expressed by Sicherman and Galor (1990). According to this model, overeducation is the result of an individual decision to sacrifice higher wages in the short term for wage growth and upward job mobility through the acquisition of human capital on the job. Given this hypothesis, overeducation should be transitory on the individual level and result in overeducated employees exhibiting superior performance compared to their adequately educated colleagues in the same job. Specifically, there should be observable differences in wage growth over time as well as upward labor market mobility. Empirical analyses have yielded mixed results for both effects.[1]

This paper aims to provide an empirical analysis of the career mobility model for Germany which avoids the two most prevalent problems in previous studies. First, we use the most reliable measure for educational mismatch based on scientific consensus, namely the Job Analysis (JA) approach, avoiding the subjectivity issues of the Worker Self Assessment (WA) approach, as well as the endogeneity issues accompanying the Realized Matches (RM) approach. By using a recent classification scheme, we are able to rule out variations in educational requirements within occupations over time, which might not be reflected in older job classifications. Second, by comparing overeducated individuals to their adequately educated colleagues in the same job, rather than their educational peers, we avoid neglecting occupation-specific differences in upward mobility and wage growth.

Our analysis provides conclusive evidence for the career mobility theory in Germany. Overeducated individuals achieve significantly higher wage growth in all job types. Also, upward labor market mobility compared to their adequately educated colleagues is higher in the category of skilled jobs. Additionally, our results confirm that overeducated individuals choose on-the-job training as a way to acquire human capital in order to move up the job ladder. This is especially the case for employees in jobs at the lower end of the job distribution.

[1]See for example: Büchel and Mertens (2004), Rubb (2006), Korpi and Tahlin (2009), Grunau and Pecoraro (2017), and Wen and Maani (2018).

The rest of the paper is organized as follows. After an overview of the underlying theories and a review of the relevant literature, we describe our empirical strategy and the data we use in Section 3. Section 4 presents and interprets the estimation results. We conclude the paper in Section 5.

2 Theory and Literature

Human capital theory is frequently consulted when wages of mismatched workers are analyzed. Based on this theory, more (less) education than required for a particular job should yield a return (penalty) which is equal to the return of the actual years of schooling (Mincer (1974); Hartog and Oosterbeek (1988); Bauer (2002)). However, various empirical studies contradict this implication and support the human capital compensation hypothesis, which is based on the premise that overeducated individuals compensate a lack of other human capital endowments by attaining more schooling than required for a given job, whereas underqualified employees feature strengths in other fields of human capital, substituting for lacking years of education (Rubb (2006); Korpi and Tahlin (2009)). Hence, when measuring the extent of mismatch solely on the basis of educational attainment, the wage effects found in various studies can be legitimized by the aforementioned compensating mechanism. Consequently, according to the compensation hypothesis, observed educational mismatches do not reflect actual mismatches but rather individual heterogeneity across workers (Korpi and Tahlin (2009)).

Sicherman and Galor (1990) extend the human capital theory by assuming that an individual's stock of human capital is accumulated by educational attainment, which increases lifetime income in two different ways: on the one hand, there are the well-known returns to schooling itself. On the other hand, it is hypothesized that education raises the likelihood of occupational upward mobility. The intuition behind the career mobility theory is that temporary mismatches in the form of overeducation occur if an individual considers a job below his qualification as an investment opportunity to acquire skills through, e.g., on-the-job training in order to promote future upward mobility and thus the probability to receive higher wages in the future (Sicherman and Galor (1990); Rosen (1972)). Consequently, this theory allows inferring predictions for overeducated persons only (Sicherman (1991)). Following the reasoning of the career mobility model, it can be assumed that overeducated persons predominantly work in jobs in which they expect a high probability of being promoted and in which they have the possibility of receiving extensive on-the-job training (Korpi and Tahlin (2009)). Hence, overqualified workers should exhibit a higher likelihood of receiving on-the-job training than adequately qualified employees. In addition, the probability of observing upward occupational mobility – either in form of occupational upgrading or in form of wage growth – should be higher for overeducated compared to adequately educated workers.

In line with Robst (1995), we argue that the applicability of the career mobility theory should be tested by comparing mismatched with adequately educated individuals working in jobs requiring the same level of formal qualification. Comparing a mismatched worker with an adequately educated person with the same educational attainment may yield results reflecting differences in mobility across job requirement levels as in this constellation, the overqualified employee must work in a job that requires less schooling than that of the adequately qualified. Thus, comparing employees with different educational attainments working within the same job requirement level eliminates the possibility that findings reflect differences in mobility across occupations.

In studies in which overqualified workers are compared with their educational peers, the results of analyzing upward mobility are largely consistent with the predictions of the career mobility model, i.e., overeducated employees are more likely to experience upward mobility either in form of job requirement increases or promotions (e.g., Hersch (1995); McMillen *et al.* (2007); Grunau and Pecoraro (2017)). However, the study by Büchel and Mertens (2004) indicates the opposite; overeducated employees feature an occupational disadvantage in terms of a decreased probability to move upward compared to adequately educated workers with the same level of qualification. Studies in which upward mobility patterns of overeducated are compared with those of adequately educated persons working in the same job requirement level yield supportive evidence for an increased probability of upward mobility for overqualified employees (e.g., Robst (1995); Groeneveld and Hartog (2004); Rubb (2006)). Though, in the study by Wen and Maani (2018), results indicate that within occupations overeducation is associated with occupational disadvantages concerning upward mobility.

Regarding the alternative measure for upward mobility, literature reveals mixed evidence regardless of whether it is controlled for the required or the actual level of education. While Grunau and Pecoraro (2017) reveal that wages of overeducated workers grow more than that of their educational peers, at least if they engage in internal or external mobility, Büchel and Mertens (2004) show that wages of overeducated workers are less likely to increase above the average wage compared to adequately educated workers with the same educational attainment. The study of McMillen *et al.* (2007) suggests that wage growth of overeducated employees does not significantly deviate from that of adequately educated persons with the same amount of schooling. Likewise, Korpi and Tahlin (2009) find no significant difference between the returns to required and surplus education in terms of wage growth, even though the reference group consists of adequately educated workers within the same job requirement. However, there are several other studies yielding support for an increased wage growth for overqualified employees when controlling for the required level of qualification (e.g., Groeneveld and Hartog (2004); Rubb (2006); Wen and Maani (2018)).

Concerning training measures, the economic literature does not provide conclusive evidence as well. In line with the underlying theoretical model, the study of McMillen *et al.*

(2007) reveals that overeducated workers feature a higher probability to receive training that is considered useful for future jobs compared to their educational peers. In other studies, it is shown that overeducated workers receive less on-the-job training and are less likely to acquire useful knowledge for promotion compared to adequately educated workers with the same formal qualification (Büchel and Mertens (2004)) or within the same job requirement (Robst (1995)).

3 Empirical Strategy and Data

To test the career mobility hypothesis, we estimate two Probit and one OLS model. The models are of the form

$$y_{it} = \alpha OV_{it} + X'_{it}\theta + \sum \gamma_t T_t + \sum \delta_f B_f + \sum \lambda_j K_j + \varepsilon_{it}, \tag{1}$$

which describes an individual i's outcome in year t. The models differ with respect to their dependent variable. One of the binary dependent variable measures skill acquisition in the form of on-the-job training. A further outcome is job mobility which is defined as a binary dependent variable equal to unity, if an increase in the job requirement level as measured by the German Classification of Occupations (KldB 2010) can be observed. We further analyze the effect educational mismatch has on wage growth by estimating the model by OLS using real hourly wage growth (in %) from $t-1$ to t as outcome of interest.

As outlined before, it is necessary to compare employees working in occupations with the same required level of formal educational in order to eliminate the possibility that the obtained estimates reflect differences in average mobility or training in the different job requirement levels. Instead of controlling for the required level of qualification, we apply subsample regressions for each job requirement level. These categories are defined as follows.

In the category *Unskilled/semi-skilled tasks*, occupations which require no or only little subject-specific knowledge are included. Thus, jobs are classified into this category if no vocational qualification, or just one year of vocational training is required. The category *Skilled tasks* describes activities for which two or three years of vocational training or a comparable qualification such as graduation from a vocational school is necessary. The category *Complex tasks* contains activities for which specialized knowledge is a prerequisite. Hence, occupations are assigned to this category if a bachelor's degree, a completed master craftsmanship or technician's training, an equivalent technical or graduate degree is required. *Highly complex tasks* include jobs for which more than four years of tertiary education (i.e., a master's degree, diploma, state examination, doctoral degree, or postdoctoral qualification) are demanded.

By estimating subsample regressions for each of these four requirement levels, we are able to compare overeducated with adequately educated workers with less educational

attainment working in an occupation that requires the same level of formal qualification.[2] The advantage of the applied approach over controlling for required qualification is that it enables to identify labor market mobility of mismatched workers in more detail, i.e., for each job requirement level separately. In some job requirement levels – by definition – individuals cannot be over- or underqualified. In the highest job requirement level there are no overqualified individuals, whereas in the lowest category of requirements, no underqualified employees can be observed.

The binary explanatory variable of main interest is OV_{it}. It is equal to one when an individual is overqualified and zero otherwise. The respective coefficient is included in α.

The choice of covariates, which are equal in both the OLS and the Probit models, is based on comparable studies and their availability in the data. Besides individual characteristics, job-specific features are included as control variables in the vector X_{it}. The respective coefficients are incorporated in the vector θ. To account for a possible nonlinear influence of age, the variable is incorporated in linear and quadratic form into the models. The marital status is controlled for by including a binary variable that is equal to unity if the respondent is married and equal to zero otherwise. A dummy variable which is intended to control for the effect of children on mobility takes the value one if there are children younger than 16 years in the same household as the respondent, and zero otherwise. Gender-specific differences in labor market mobility, and migration status are also captured by a dummy variable. Job-specific control variables refer to respondent's time within the firm (linear and quadratic), his type of contract (permanent or temporary), whether he or she works full- or part-time, the number of employees in the firm, and his or her earnings. As wage is assumed to be negatively correlated with labor market mobility, we control for potential wage effects on labor market mobility by including the logarithmized gross hourly real wage. Furthermore, a binary variable being equal to one when an individual is underqualified and zero otherwise is controlled for in order to compare the coefficient of the variable of interest with respect only to adequately educated individuals.

To control for time-specific differences in mobility, the vector T_t includes a full set of binary year indicators. The vector B_f contains a full set of federal state dummy variables. Differences in mobility within occupational areas, which are constant across time, federal states, and individuals, are controlled for by including a full set of occupational main group indicators in the vector K_m (defined by the ISCO standard).[3]

The data used in this study stems from the German Socio-Economic Panel (GSOEP) covering the period 2013 to 2016.[4] In our analysis, we restrict the sample to full- and part-time employed individuals aged between 18 and 65 years. Self-employed respondents, members of the armed forces, and individuals in education or with foreign vocational

[2]This approach was applied by Bauer *et al.* (2018) to analyze the effect of underqualification on earnings.
[3]In Table A1, all variables are listed.
[4]Information on the KldB 2010 is included in the data starting in 2013. The wave from 2016 is the most recent wave available.

degrees are dropped from the sample.[5] After applying these restrictions to the GSOEP data, the remaining sample contains 24,061 person-year observations. To get a general impression of the sample used for the econometric analysis, descriptive statistics of all variables in the full sample are provided in Table 1.

To construct an objective measure for defining mismatches, we make use of the KldB 2010 issued by the Federal Employment Agency. Against the background of the dynamic development of job requirements due to the technological progress, it is indispensable that the JA definition of job requirements has to be updated frequently in order to remain reliable (Verhaest and Omey (2006)). By utilizing the latest classification scheme, i.e., the KldB 2010 – which has been adjusted to the developments in the German labor market, the potential unreliability of the JA measure which occurs when employing outdated schemes is eliminated. The KldB 2010 contains four task-based vertical dimensions of occupations. The evaluation of the required qualification is closely aligned with formal degrees due to the strict formal requirements in form of certificates as prerequisite for many occupations in Germany (Paulus *et al.* (2010)).

In order to classify a person as over-, under-, or adequately educated according to the JA method, the formal qualifications of the respondents are matched with the classification of the KldB 2010.[6] In *Unskilled/semi-skilled tasks*, employees are adequately educated if they do not have a vocational degree independent of their school-leaving degree. This implies that in this category the attained years of schooling can vary substantially since it comprises persons with no school degree up to those who attained an upper secondary degree. In consequence, individuals without a vocational degree cannot be classified as being overqualified. Those who have completed vocational training are adequately educated if they work in an occupation in which *Skilled tasks* are performed. Unfortunately, the SOEP does not provide the possibility to distinguish between one, two, or three years of vocational training. Thus, it is not feasible to classify persons with only one year of vocational training as adequately educated if they work in *Unskilled/semi-skilled tasks* as it should be done consistently with the classification of the Kldb 2010. Due to this restriction imposed by the data, it might be the case that persons with only one year of vocational training working in occupations in which *Skilled tasks* are required are identified as adequately educated even though they have less education than actually required according to the KldB 2010 classification. This implies a potential underestimation of the incidence of undereducation. In the *Complex tasks* category, individuals' educational attainment corresponds to the required qualification if they have a bachelor's degree or a qualification as master craftsman, technician or an equivalent college or technical school degree. The qualification of employees who have completed at least four years of tertiary education complies with the requirements in the category *Highly complex tasks*.

[5]To anticipate potential measurement issues, the top and bottom 0.5% of wage distribution are excluded from the analysis.

[6]In Table A2, a detailed overview of the classification of degrees into the different levels of formal qualifications is provided.

Table 2 displays the shares of the formal qualification levels among the job requirement levels. The entries on the main diagonal describe the share of adequately qualified individuals. Entries below the main diagonal describe the shares of the underqualified, and the entries above those of the overqualified. As can be seen, especially for those having no vocational training, the likelihood of working in an overqualified job is very high. Only 26% work in adequately qualified jobs, while 55% work in skilled tasks, therefore being overqualified. A different picture can be observed for the workers having completed vocational training. Almost 73% work in adequately qualified jobs and only 9% work in unskilled tasks. The rest is working in jobs above their formal qualification, i.e. in complex and highly complex tasks. For people having a formal qualification as a master craftsman/technician/bachelor more than half work in jobs that have a job requirement level below their qualification. 49% are working in skilled and 3% in unskilled tasks. 24% are working in jobs with complex tasks, and another 24% work in jobs with highly complex tasks. People having a graduate degree are likely to work in jobs that match their formal qualification. Around 71% of them are adequately qualified.

The applicability of the career mobility theory is tested by utilizing information on training, increases in job requirement level, and wage growth. In the data, on-the-job training is specified as training that is based on previous professional training or which is intended to support a subsequent change of profession (TNS Infratest Sozialforschung, 2016, p.45). Hence, we construct a dummy variable for on-the-job training, which is equal to one if the respondent states in the subsequent year $(t+1)$ that he received further vocational training in the previous year (t), and zero otherwise $(m = 1)$. As the career mobility model predicts that overqualified workers consider a job as an investment opportunity to acquire further skills, we expect them to be more likely to receive on-the-job training than their adequately educated co-workers, i.e., $\alpha > 0$ (for $m = 1$). In order to measure upward mobility, information on job requirement levels and wages are employed. Upward mobility measured by an increase in job requirement level from t to $t+1$ is captured by a binary indicator $(m = 2)$. Upward mobility in form of wage growth, is captured by the gross hourly real wage growth.[7] Based on the underlying theoretical model, it is expected that overeducated individuals are more mobile than adequately educated employees in the same job requirement level, i.e., $\alpha > 0$.

Table 3 provides some preliminary support for the career mobility model; overqualified workers exhibit a higher percentage share of persons who receive on-the-job training compared to their adequately educated colleagues. Another general finding revealed by these statistics is that with increasing job complexity the probability of receiving on-the-job training rises as well. Furthermore, in each job requirement level, the shares of overqualified

[7]The SOEP contains information on both agreed and actually worked hours per week, so a variable which takes on the maximum value of both answers is created. If one of these answers is missing, the variable takes on the value of the non-missing response. As the SOEP provides data on the gross wage in monthly terms, the generated information on working hours is used to calculate the number of hours worked per month. The CPI is provided by German Federal Statistical Office (2018).

workers who move upward are larger than that of the adequately educated employees. Since upward mobility is defined as an increase in job requirement, no upward movement is possible in the highest job requirement level and thus no results can be reported for the highly complex jobs. Considering wage growth, consistent with the predictions of the career mobility model, in each job requirement level the average earnings growth of overqualified workers is larger than that of the adequately educated co-workers.

4 Results

In the subsequent tables, the results of the Probit and OLS regressions are presented. Table A5 contains the coefficients from the wage growth regressions. In the Probit model, the marginal effects depend on the value of the explanatory variables. All estimation results, coefficients or marginal effects respectively, can be found in Tables A3 to A5. To obtain results for mismatched workers' labor market mobility, which are comparable in magnitude across the different job requirement levels, the relative percentage difference between labor market mobility of mismatched and adequately educated workers are calculated if there is a significant difference in mobility.[8]

The job career mobility model should be tested by comparing persons within the same job requirement level in order to eliminate the possibility that findings reflect differences in average mobility in the different job requirement levels. Thus, in the subsequent tables, the results of estimating regressions for each job requirement level separately are depicted. Even though the career mobility theory allows to infer predictions for overqualified workers only, for the sake of completeness, the AMEs for underqualified employees are depicted as well.

The starting point of the career mobility analysis refers to the acquisition of skills, which are intended to promote future upward mobility. Since on-the-job training should improve promotion prospects, overqualified are supposed to feature a higher probability of receiving on-the-job training compared to their adequately educated colleagues. Table A3 underlines that the likelihood of receiving on-the-job training of overqualified workers in unskilled/semi-skilled jobs is 4.51 percentage points higher than that of their adequately educated co-workers, for skilled jobs, the corresponding values are 6.9 percentage points. In occupations characterized by complex tasks, there is no significant difference in the probability of receiving on-the-job training between overqualified and adequately qualified workers.

Further evidence supporting the implications of the career mobility theory is illustrated in Table A4 in which upward mobility is defined by an increase in job requirement. Results

[8]For deriving the relative percentage differences the predicted values of the respective dependent variable at both states of over- and underqualification (i.e., $\hat{Y}_{OV=0}$ and $\hat{Y}_{OV=1}$; $\hat{Y}_{UN=0}$ and $\hat{Y}_{UN=1}$) are calculated. The relative percentage difference is derived by: $\Delta^{OV}\% = (\hat{Y}_{OV=1} - \hat{Y}_{OV=0})/\hat{Y}_{OV=0}$ and $\Delta^{UN}\% = (\hat{Y}_{UN=1} - \hat{Y}_{UN=0})/\hat{Y}_{UN=0}$.

for the highest job requirement levels cannot be reported as in these categories no upward movement is possible.[9] Only in jobs with a skilled requirement level, overqualified workers exhibit a significantly increased likelihood of moving upward the career ladder compared to their adequately qualified colleagues. Overqualified employees are 2.7 percentage points more likely to experience upward mobility.

Defining upward mobility by wage growth yields the most conclusive results which support the previous findings on upward transitions (cf. Table A5); in all job requirement levels, the gross hourly real wages of overqualified workers grow significantly more than that of their adequately educated co-workers. In unskilled/semi-skilled jobs the spread between overqualified and adequately educated workers' wage growth rates is 9.78%, in skilled jobs, wages of overqualified persons increase 3.86% more than that of adequately qualified individuals, and in complex jobs the difference in earnings increase amounts 6%.

Econometric problems, which have rather been noticed in the earnings literature, might have an impact on the obtained findings. Certainly, it should be taken into account that the results might be influenced by individual heterogeneity such as ability. According to the human capital compensation hypothesis, overeducated persons compensate lacking endowments in human capital other than educational attainment by surplus schooling. Provided that this assumption is valid, and that ability is correlated with mismatch and influences upward mobility and training through other channels than mismatch, ability represents an omitted variable. As it is presumably the case that ability and upward movements/acquisition of further skills are positively linked, and if it is assumed consistently with the human capital compensation hypothesis that overqualification and ability are negatively correlated, the estimates obtained for overqualified workers are biased downward implying an underestimation of the effects in all estimated models. Under the aforementioned premises, the obtained estimates can be considered as lower bound (in absolute terms) for the true effects.

Besides individual heterogeneity, potential job heterogeneity might bias the results as well. If this unobserved job heterogeneity is correlated with the respective mismatch states and influences upward mobility and training through other channels than overqualification, it biases the observed effects. The direction of the bias depends, on the one hand, on the correlation between the mismatch state and the omitted job heterogeneity and, on the other hand, on the correlation between upward mobility or training and the omitted variable. For instance, it is conceivable that due to skills shortage in some jobs in which the supply of potential workers is relatively high, it is more likely that employers feature a tendency to hire persons whose formal qualification is above the actual job requirements. Consequently, under this premise, overqualification and skills shortage are negatively related. As it could be presumed that upward mobility and training are positively related with skills shortage, this would imply that the estimates for overqualification are biased downward. Obviously,

[9]Certainly, they are dispensable anyway since in the highest job requirement level, overqualification is not observable.

this scenario yields equivalent bias directions as in the above described case of omitted individual heterogeneity and thus the obtained estimates for overqualification should be regarded as lower bounds (in absolute terms) for the true effects.

As overeducation are probably measured with an error, coefficients could be biased toward zero, which corresponds to the bias direction outlined in both previous scenarios. Consequently, the obtained estimates should be regarded as lower bounds (in absolute terms) for the true effects as well in this case.

5 Conclusion

In this article, we test the validity of the career mobility model for the German labor market. The career mobility model predicts that overeducated workers perform better than their adequately educated colleagues in terms of job mobility and wages. According to the model, this is partly explained due to higher participation rates of overeducated workers in on-the-job training.

In order to test this theory empirically, we build on the work of Robst (1995), who argues to compare overeducated workers with their adequately educated colleagues in the same job. To measure skill requirements in different jobs, we use the JA approach based on the KldB 2010 classification scheme, which has been established by previous literature as the most reliable method. On this basis, the job categories *unskilled*, *skilled*, *complex*, and *highly complex* are constructed. We estimate Probit and OLS models with upward job changes, wage growth, and participation in on-the-job training as dependent variables. We use the SOEP covering the period 2013 to 2016, and restrict the sample to 18 to 65 year olds with completed education. Our restricted sample contains 24,061 person-year observations.

Our results show that the implications of the career mobility model concerning the relationship between overeducation and job mobility seem to be valid for the German labor market. Overqualified workers' wages do indeed grow systematically at a higher rate, and overqualified workers have a higher probability of upward job mobility compared to their adequately educated counterparts, at least partially. Whereas the results concerning wage growth hold true for all analyzed job types, higher upward mobility can only be observed for skilled jobs. Additionally, we could confirm that on-the-job training is an important channel to increased wage-growth and upward job mobility, at least for unskilled/semi-skilled jobs and skilled jobs.

The results suggest that overeducated individuals perform better than adequately educated persons in the same jobs. This seems to contradict the notion that overeducated workers are stuck in inadequate professions is wrong, at least for certain job types. Furthermore, overeducated workers out-earn their colleagues, suggesting that the over-investment in human capital is lower than expected.

References

Bauer, T. K. (2002). Educational mismatch and wages: a panel analysis. *Economics of Education Review*, **21** (3), 221–229.

—, Rulff, C. and Tamminga, M. (2018). Formale Unterqualifikation in Deutschland – Empirie und wirtschaftswissenschaftliche Perspektive. In M. Bürmann (ed.), *Formale Unterqualifikation auf dem deutschen Arbeitsmarkt*, Bertelsmann Stiftung, pp. 4–35.

Büchel, F. and Mertens, A. (2004). Overeducation, undereducation, and the theory of career mobility. *Applied Economics*, **36** (8), 803–816.

German Federal Statistical Office (2018). Consumer prices. https://www.destatis.de/EN/FactsFigures/NationalEconomyEnvironment/Prices/ConsumerPriceIndices/Tables_/ConsumerPricesCategories.html?cms_gtp=151226_slot%253D2, date of access: June 20, 2018.

Groeneveld, S. and Hartog, J. (2004). Overeducation, wages and promotions within the firm. *Labour Economics*, **11** (6), 701–714.

Grunau, P. and Pecoraro, M. (2017). Educational mismatch and promotions to managerial positions: a test of the career mobility theory. *Applied Economics*, **49** (12), 1226–1240.

Hartog, J. and Oosterbeek, H. (1988). Education, allocation and earnings in the Netherlands: overschooling? *Economics of Education Review*, **7** (2), 185–194.

Hersch, J. (1995). Optimal "mismatch" and promotions. *Economic Inquiry*, **33** (4), 611–624.

Korpi, T. and Tahlin, M. (2009). Educational mismatch, wages, and wage growth: overeducation in Sweden, 1974–2000. *Labour Economics*, **16** (2), 183–193.

McMillen, D. P., Seaman, P. T. and Singell Jr., L. D. (2007). A mismatch made in heaven: a hedonic analysis of overeducation and undereducation. *Southern Economic Journal*, **73** (4), 901–930.

Mincer, J. (1974). The human capital earnings function. In J. Mincer (ed.), *Schooling, Experience, and Earnings*, Columbia University Press, pp. 83–96.

Paulus, W., Schweitzer, R. and Wiemer, S. (2010). *Klassifikation der Berufe 2010 – Entwicklung und Ergebnis*. Nürnberg: Bundesagentur für Arbeit.

Robst, J. (1995). Career mobility, job match, and overeducation. *Eastern Economic Journal*, **21** (4), 539–550.

Rosen, S. (1972). Learning and experience in the labor market. *Journal of Human Resources*, **7** (3), 326–342.

Rubb, S. (2006). Educational mismatches and earnings: extensions of occupational mobility theory and evidence of human capital depreciation. *Education Economics*, **14** (2), 135–154.

Sicherman, N. (1991). "Overeducation" in the labor market. *Journal of Labor Economics*, **9** (2), 101–122.

— and Galor, O. (1990). A theory of career mobility. *Journal of Political Economy*, **98** (1), 169–192.

TNS Infratest Sozialforschung (2016). SOEP 2016 – Erhebungsinstrumente 2016 (Welle 33) des Sozio-oekonomischen Panels: Personenfragebogen, Stichproben A-L3. *SOEP Survey Papers*, **345** (Series A), 1–74.

Verhaest, D. and Omey, E. (2006). Discriminating between alternative measures of over-education. *Applied Economics*, **38** (18), 2113–2120.

Wen, L. and Maani, S. A. (2018). Job mismatches and career mobility. *Applied Economics*, pp. 1–15.

Tables

Table 1: Descriptive statistics of the full sample

	Mean	Std. Dev.	Min.	Max.
Labor market mobility				
OJT	0.3230	0.4676	0.00	1.00
Upward mobility	0.0458	0.2090	0.00	1.00
Wage growth	0.0726	0.5312	−1.00	42.65
Educational mismatch				
Overqualified	0.2377	0.4257	0.00	1.00
Adequately qualified	0.5488	0.4976	0.00	1.00
Underqualified	0.2135	0.4098	0.00	1.00
Job-specific characteristics				
Tenure	12.4973	10.8538	0.00	48.80
Full time	0.7727	0.4191	0.00	1.00
Permanent	0.9144	0.2797	0.00	1.00
Below 100	0.3736	0.4838	0.00	1.00
100 to 199	0.0934	0.2910	0.00	1.00
200 to 1999	0.2382	0.4260	0.00	1.00
2000 and more	0.2948	0.4560	0.00	1.00
Wage	16.4398	7.5347	2.54	53.50
Individual characteristics				
Age	44.5494	10.6781	18.00	65.00
Male	0.5409	0.4983	0.00	1.00
Migrant	0.0880	0.2833	0.00	1.00
Married	0.5634	0.4960	0.00	1.00
Children	0.2754	0.4467	0.00	1.00
Observations	24,061			

Source: SOEP (2013-2016), own calculations.
Notes: Weighted with weights provided by the SOEP.

Table 2: Shares of formal qualifications in each job requirement level (in %)

	Job requirement level			
Formal qualification	Unskilled/ semi-skilled tasks	Skilled tasks	Complex tasks	Highly complex tasks
No vocational training	25.83	55.18	8.50	10.49
Vocational training	9.38	72.64	11.00	6.98
Master craftsmen/technician/bachelor	3.07	49.21	23.85	23.87
Graduate degree (>4 years)	0.43	9.02	19.99	70.56
Total	7.54	53.93	15.84	22.69

Source: SOEP (2013-2016), own calculations.
Notes: Weighted with weights provided by the SOEP.

Table 3: Shares of workers receiving on-the-job training, experiencing upward mobility, and wage growth by job requirement level and mismatch (in %)

	Job requirement level			
Formal qualification	Unskilled/ semi-skilled tasks	Skilled tasks	Complex tasks	Highly complex tasks
	On-the-job training			
Overqualified	14.23	36.76	45.07	0
Adequately qualified	8.89	23.7	38.67	54.78
Underqualified	0	16.82	35.14	39.43
	Upward mobility			
Overqualified	15.1	6.82	14.66	0
Adequately qualified	11.68	3.37	7.13	0
Underqualified	0	2.68	4.2	0
	Wage growth			
Overqualified	10.57	7.36	7.16	0
Adequately qualified	6.73	6.04	3.94	7.87
Underqualified	0	5.9	6.07	12.14

Source: SOEP (2013-2016), own calculations.
Notes: Weighted with weights provided by the SOEP.

Table 4: Educational Mismatch Coefficient Estimates

	Unskilled/ semi-skilled tasks	Skilled tasks	Complex tasks	Highly complex tasks
On-the-job training				
Overqualified	0.0451**	0.0690†	0.0493	–
	(0.0212)	(0.0184)	(0.0416)	–
Underqualified	–	−0.0405	−0.0315	−0.0999†
	–	(0.0246)	(0.0329)	(0.0287)
Upward mobility				
Overqualified	0.0327	0.0270†	0.0227	–
	(0.0219)	(0.0074)	(0.0181)	–
Underqualified	–	0.0014	−0.0152	–
	–	(0.0099)	(0.0145)	–
Wage growth				
Overqualified	0.0978**	0.0386†	0.0600***	–
	(0.0455)	(0.0109)	(0.0209)	–
Underqualified	–	−0.0372**	−0.0078	0.0011
	–	(0.0171)	(0.0138)	(0.0423)

Source: SOEP (2013-2016), own calculations.
Notes: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. *Cluster-robust standard errors are in parentheses (clustered on individual level). Weighted with weights provided by the SOEP. Year, federal state, and occupational main group fixed effects are additionally included.*

A Appendix

Table A1: Description of variables

Variable	Description
Dependent variables	
OJT	= 1 if on-the-job training in current year, 0 ow
Upward mobility	= 1 if increase in job requirement (JA) from t to $t+1$, 0 ow
Wage growth	Wage growth in percent in current year
Explanatory variables	
Overqualified	= 1 if overqualified (JA method), 0 ow
Adequately qualified	= 1 if adequately qualified (JA method), 0 ow
Underqualified	= 1 if underqualified (JA method), 0 ow
Tenure	Length of time with firm in years
Tenure^2	Length of time with firm in years (squared)
Full time	= 1 if full-time employed, 0 ow
Permanent	= 1 if permanent contract, 0 ow
Below 100	= 1 if less than 100 employees, 0 ow
100 to 199	= 1 if 100 to 199 employees, 0 ow
200 to 1999	= 1 if 200 to 1999 employees, 0 ow
2000 and more	= 1 if more than 2000 employees, 0 ow
Ln(wage)	Logarithm of gross hourly real wage
Age	Age in years
Age^2	Age in years (squared)
Male	= 1 if male, 0 ow
Migrant	= 1 if migrant, 0 ow
Married	= 1 if married, 0 ow
Children	= 1 if child(ren) below 16 years in household, 0 ow

Source: SOEP (2013-2016), own definitions.

Table A2: Description of formal qualifications and classification of degrees into the categories of formal qualification (JA method)

Formal qualification	**Description**	**Highest degree obtained**
No vocational training	No formal occupational degree or only one year training	No degree (dropouts) Intermediate school degree Advanced technical college entrance qualification General qualification for university entrance
Vocational training	Completed two or three years of vocational training, corresponding work experience and/or informal training	Apprenticeship
Master craftsman / technician / bachelor	Master craftsman / technician / bachelor	Vocational school degree Health care school degree Completed civil service training Technical school degree Bachelor (university or technical college)
Graduate degree	Graduate degree (at least 4 years)	Diploma (university or technical college) Master (university or technical college) State examination Doctoral level Postdoctoral level

Source: SOEP (2013-2016), KldB 2010, own classification of degrees into formal qualification categories.

Table A3: Mismatch and on-the-job training by job requirement level

	Unskilled/ semi-skilled tasks	Skilled tasks	Complex tasks	Highly complex tasks
Educational mismatch				
Overqualified	0.0451**	0.0690†	0.0493	–
	(0.0212)	(0.0184)	(0.0416)	–
Underqualified	–	−0.0405	−0.0315	−0.0999†
	–	(0.0246)	(0.0329)	(0.0287)
Job-specific characteristics				
Tenure	−0.0007	−0.0017*	−0.0017	−0.0017
	(0.0018)	(0.0010)	(0.0020)	(0.0021)
Tenure^2	–	–	–	–
	–	–	–	–
Full time	0.0189	−0.0035	−0.0829**	0.0065
	(0.0221)	(0.0186)	(0.0404)	(0.0346)
Permanent	−0.0068	0.0115	0.1335**	0.0619
	(0.0253)	(0.0246)	(0.0600)	(0.0438)
Firm size (ref.: Below 100)				
100 to 199	0.0669**	0.0185	0.0450	−0.0140
	(0.0328)	(0.0223)	(0.0506)	(0.0446)
200 to 1999	0.0274	0.0307*	0.0677*	−0.0078
	(0.0218)	(0.0184)	(0.0398)	(0.0350)
2000 and more	0.0877***	0.0337*	0.1141***	0.0548*
	(0.0285)	(0.0190)	(0.0392)	(0.0302)
Ln(wage)	0.0235	0.0982†	0.0154	0.1411†
	(0.0296)	(0.0236)	(0.0504)	(0.0338)
Individual characteristics				
Age	−0.0010	−0.0007	0.0002	−0.0026
	(0.0012)	(0.0010)	(0.0019)	(0.0017)
Age^2	–	–	–	–
	–	–	–	–
Male	0.0418*	0.0265	−0.0258	−0.0754***
	(0.0244)	(0.0185)	(0.0354)	(0.0289)
Migrant	−0.0429*	−0.0625**	0.0723	−0.0837
	(0.0241)	(0.0244)	(0.0750)	(0.0618)
Married	0.0379*	−0.0038	0.0030	−0.0464
	(0.0198)	(0.0170)	(0.0336)	(0.0304)
Children	0.0076	0.0279	0.0694**	0.0047
	(0.0229)	(0.0170)	(0.0339)	(0.0311)
Δ OV%	51.25%	16.27%	15.39%	–
Year dummies	yes	yes	yes	yes
Occupational dummies	yes	yes	yes	yes
Federal state dummies	yes	yes	yes	yes
Pseudo-R^2	0.2368	0.0591	0.0376	0.0569
Observations	1,942	12,826	3,705	5,578

Source: SOEP (2013-2016), own calculations.
Notes: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. *Cluster-robust standard errors are in parentheses (clustered on individual level). Weighted with weights provided by the SOEP. Year, federal state, and occupational main group fixed effects are additionally included.* Δ^{OV} *%* (Δ^{UN} *%) refers to the percentage difference between overqualified (underqualified) and adequately qualified workers' probability of receiving on-the-job training.*

Table A4: Mismatch and upward mobility by job requirement level

	Unskilled/ semi-skilled tasks	Skilled tasks	Complex tasks
Educational mismatch			
Overqualified	0.0327	0.0270†	0.0227
	(0.0219)	(0.0074)	(0.0181)
Underqualified	–	0.0014	−0.0152
	–	(0.0099)	(0.0145)
Job-specific characteristics			
Tenure	−0.0026	−0.0009**	−0.0035***
	(0.0023)	(0.0004)	(0.0012)
Tenure^2	–	–	–
	–	–	–
Full time	−0.0035	0.0218†	−0.0193
	(0.0234)	(0.0061)	(0.0240)
Permanent	−0.0201	−0.0241*	−0.0406
	(0.0284)	(0.0140)	(0.0404)
Firm size (ref.: Below 100)			
100 to 199	−0.0524**	−0.0273†	0.0322
	(0.0253)	(0.0062)	(0.0247)
200 to 1999	0.0326	0.0094	0.0255
	(0.0291)	(0.0085)	(0.0170)
2000 and more	−0.0004	0.0028	0.0232
	(0.0275)	(0.0074)	(0.0175)
Ln(wage)	−0.0210	0.0262***	0.0939†
	(0.0351)	(0.0096)	(0.0249)
Individual characteristics			
Age	−0.0049†	−0.0002	−0.0025***
	(0.0012)	(0.0003)	(0.0009)
Age^2	–	–	–
	–	–	–
Male	0.0865***	0.0037	0.0093
	(0.0312)	(0.0071)	(0.0167)
Migrant	−0.0079	−0.0022	0.1215***
	(0.0290)	(0.0098)	(0.0421)
Married	0.0032	−0.0087	−0.0037
	(0.0228)	(0.0066)	(0.0145)
Children	−0.0274	−0.0011	−0.0272**
	(0.0222)	(0.0066)	(0.0137)
Δ OV%	28.69%	110.03%	38.61%
Year dummies	yes	yes	yes
Occupational dummies	yes	yes	yes
Federal state dummies	yes	yes	yes
Pseudo-R^2	0.2456	0.1887	0.2685
Observations	1,950	12,553	3,440

Source: SOEP (2013-2016), own calculations.
Notes: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. *Cluster-robust standard errors are in parentheses (clustered on individual level). Weighted with weights provided by the SOEP. Year, federal state, and occupational main group fixed effects are additionally included.* Δ^{OV}*%* (Δ^{UN}*%) refers to the percentage difference between overqualified (underqualified) and adequately qualified workers' probability of experiencing upward mobility.*

Table A5: Mismatch and wage growth by job requirement level

	Unskilled/ semi-skilled tasks	Skilled tasks	Complex tasks	Highly complex tasks
Educational mismatch				
Overqualified	0.0978**	0.0386†	0.0600***	–
	(0.0455)	(0.0109)	(0.0209)	–
Underqualified	–	−0.0372**	−0.0078	0.0011
	–	(0.0171)	(0.0138)	(0.0423)
Job-specific characteristics				
Tenure	0.0041	0.0054†	−0.0002	0.0033
	(0.0045)	(0.0015)	(0.0024)	(0.0034)
Tenure^2	0.0001	−0.0001***	0.0000	0.0000
	(0.0001)	(0.0000)	(0.0001)	(0.0001)
Full time	−0.0015	0.0140	0.0679**	0.0158
	(0.0300)	(0.0116)	(0.0281)	(0.0377)
Permanent	0.0591	−0.0064	−0.0735	−0.0905*
	(0.0464)	(0.0211)	(0.0569)	(0.0483)
Firm size (ref.: Below 100)				
100 to 199	0.0221	0.0493*	0.0788*	−0.0412
	(0.0486)	(0.0264)	(0.0438)	(0.0263)
200 to 1999	0.0455	0.0543†	0.0543***	0.0304
	(0.0392)	(0.0107)	(0.0176)	(0.0314)
2000 and more	0.1054***	0.0808†	0.0635†	0.1054***
	(0.0350)	(0.0130)	(0.0189)	(0.0405)
Ln(wage)	−0.6648†	−0.3747†	−0.3215†	−0.4409†
	(0.1621)	(0.0340)	(0.0499)	(0.0787)
Individual characteristics				
Age	0.0193	−0.0053	0.0133**	0.0022
	(0.0127)	(0.0041)	(0.0063)	(0.0107)
Age^2	−0.0002	0.0001	−0.0001*	−0.0000
	(0.0002)	(0.0000)	(0.0001)	(0.0001)
Male	0.0758*	0.0450†	−0.0164	0.0577
	(0.0395)	(0.0127)	(0.0150)	(0.0377)
Migrant	0.0105	−0.0081	0.0154	−0.0398
	(0.0298)	(0.0132)	(0.0372)	(0.0450)
Married	0.0481	0.0177*	−0.0201	0.0700**
	(0.0509)	(0.0098)	(0.0132)	(0.0326)
Children	−0.0238	0.0284**	0.0252	0.0041
	(0.0575)	(0.0138)	(0.0163)	(0.0337)
Constant	0.9823†	0.9684†	0.6358†	1.4364†
	(0.2870)	(0.1281)	(0.1483)	(0.2971)
Year dummies	yes	yes	yes	yes
Occupational dummies	yes	yes	yes	yes
Federal state dummies	yes	yes	yes	yes
R^2	0.1772	0.1182	0.1476	0.0341
Observations	1,950	12,828	3,705	5,578

Source: SOEP (2013-2016), own calculations.
Notes: † $p < 0.001$; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$. *Cluster-robust standard errors are in parentheses (clustered on individual level). Weighted with weights provided by the SOEP. Year, federal state, and occupational main group fixed effects are additionally included.*