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Educational attainment, age
and the consequences
of job loss: empirical
evidence from Germany

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WORKING
PAPERS

ECONOMICS DEPARTMENT**EDUCATIONAL ATTAINMENT, AGE AND THE CONSEQUENCES OF JOB LOSS –
EMPIRICAL EVIDENCE FROM GERMANY****ECONOMIC DEPARTMENT WORKING PAPER No. 1558**

By Alexandra Effenberger, Verena Lauber, Sebastian Schmitz and Charlotte Senfleben-König

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ABSTRACT/RÉSUMÉ**Educational Attainment, Age and the Consequences of Job Loss –
Empirical Evidence from Germany**

Education is a crucial determinant of labour market success. We investigate whether education is an appropriate means to cushion the negative consequences of job loss and study the role of age as a second major labour market factor. Using German Socio-Economic Panel (SOEP) data for the years 2000 to 2016, we analyse unemployment durations and unemployment-induced wage penalties for prime-age men. We show that individuals without formal qualifications face a significantly lower probability of finding a new job than workers with some kind of formal qualification, and hence face a higher risk of long-term unemployment. Furthermore, the duration of unemployment prior to finding a new job rises with age. This pattern is particularly pronounced for individuals with upper secondary education or no formal qualifications. Moreover, we find a negative relationship between unemployment and an individual's subsequent wage. This depressing impact is significant only for unqualified workers and workers with intermediate vocational education. Yet, differences between educational groups are not statistically significant. Across all education groups, unemployment depresses subsequent wages more strongly at a higher age. However, the results suggest that this is due to longer unemployment spells of older workers, not age per se.

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**Niveau d'études, âge et conséquences de la perte d'emploi –
données empiriques de l'Allemagne**

L'éducation est un déterminant clé de la réussite sur le marché du travail. Nos recherches visent à déterminer si l'éducation constitue un moyen efficace de compenser, dans une certaine mesure, les retombées négatives de la perte d'emploi, ainsi qu'à étudier l'importance de l'âge en tant que deuxième critère déterminant de la réussite sur le marché du travail. En s'appuyant sur les données de l'enquête SOEP allemande pour la période 2000-2016, nous analysons la durée des épisodes de chômage et le handicap salarial lié au chômage pour les hommes d'âge très actif. Il ressort de nos recherches que les individus sans diplôme ont beaucoup moins de chances de trouver un nouvel emploi que ceux qui sont diplômés, et donc qu'ils sont beaucoup plus exposés au risque de chômage de longue durée. Par ailleurs, plus l'âge augmente, plus la durée de la période de chômage s'allonge : ce phénomène est particulièrement prononcé chez les personnes diplômées du deuxième cycle du secondaire ou non diplômées. On constate en outre une corrélation négative entre le chômage et le salaire qui est ensuite perçu par le travailleur qui retrouve un emploi. Cet impact négatif n'est significatif que pour les travailleurs non qualifiés et les travailleurs diplômés de l'enseignement secondaire professionnel, même si les différences entre les deux groupes ne sont pas statistiquement significatives. Indépendamment du niveau de formation, les analyses montrent que plus l'âge est élevé, plus la période de chômage pèse sur les salaires perçus ultérieurement. Néanmoins, il semble que cela tienne au fait que les travailleurs plus âgés connaissent des épisodes de chômage plus longs, et non à l'âge en lui-même.

Ce document de travail porte sur l'*Étude économique de l'Allemagne 2018* de l'OCDE
(<http://www.oecd.org/fr/eco/etudes/etude-economique-allemande.htm>)

Classification JEL : J64, J31, I26

Mots-clés : durée du chômage, écarts de salaires, rendement de l'éducation.

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Educational Attainment, Age and the Consequences of Job Loss – Empirical Evidence from Germany

By Alexandra Effenberger, Verena Lauber, Sebastian Schmitz,
Charlotte Senftleben-König¹

Introduction

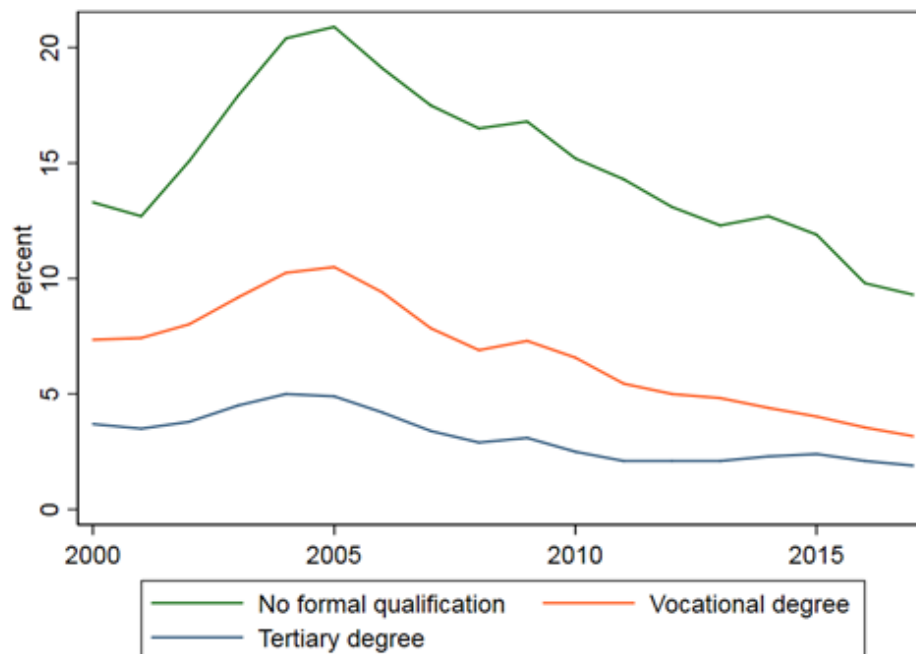
Over the last decade, the German labour market was characterised by high employment growth and a substantial reduction of unemployment. Between the years 2005 and 2017, employment subject to social security contributions increased by 6 million and the unemployment rate decreased from 11.7 to 3.3 per cent.² The declining trend has proven remarkably robust to the world economic crisis beginning in 2007 and the current number ranges among the lowest in the OECD countries (e.g. OECD 2018). The unemployment rate declined across all population groups. However, some notable differences persist (see Figure 1): While an unemployment rate of 1.9 per cent indicates full employment among workers who have obtained a tertiary or a vocational degree, the unemployed rate of workers without formal qualifications still amounted to 10 per cent in 2017. Even though the education-specific unemployment rates have converged over the period of economic upswing, the absolute differences of 7 percentage points remain significant.

The digital transformation will certainly change the nature of jobs and tasks and will likely increase the prevalence of major shocks for parts of the labour force, particularly with respect to the risk of unemployment. Although no large aggregate employment adjustments are expected in Germany (Wolter et al., 2016; Vogler-Ludwig et al., 2016), some workers may be hit more strongly than others. The probability to experience as well as the ability to cope with such a shock may depend on workers' characteristics. This paper provides new insights on the role of general education and age in mitigating the consequences of job loss. In particular, we analyse unemployment durations and unemployment-induced wage penalties. The identified patterns enhance our understanding of the interaction of these factors, adding to the assessment of the challenges induced by these upcoming structural changes.

¹ The authors are economists in the Economic Policy Department of the German Federal Ministry for Economic Affairs and Energy. The views expressed herein should be attributed to the authors and not to the German Federal Ministry for Economic Affairs and Energy or its staff. The authors would like to thank Asa Johanson, Andrés Fuentes Hutfilter, Stephanie Lehmann, Annelore Verhagen, Daniela Glocker and Eun Jung Kim for their valuable input. The data used in this analysis were made available by the German Socio-Economic Panel (SOEP) at the German Institute for Economic Research (DIW), Berlin. See Wagner et al. (2007) for a detailed description of the SOEP.

² These numbers refer to the ILO definition of unemployment.

Figure 1. Unemployment rates by educational attainment level



Source: Eurostat, unemployment rates of males and females, 25 to 54 years

Examining prime-age men (25-55), our results indicate that education might be an important factor in determining consequences of job loss, as individuals without any formal qualification face a significantly lower probability of finding a new job than all other education groups. We show that older workers take comparatively long to find a new job. This pattern is mostly driven by individuals without any formal qualification or a lower vocational degree. In terms of wage penalties, even in a period of healthy labour market and a thriving economy, the event of unemployment negatively affects subsequent wages. The magnitude of the estimated wage penalties varies across educational groups to some extent – significant wage penalties can only be observed for unqualified workers and workers with intermediate vocational education. However, differences between educational groups are not statistically significant. In addition, the estimates reveal that older individuals face a higher wage penalty. However, this seems to be driven by a longer period between separation and re-employment rather than by higher age per se.

Our findings cannot necessarily be interpreted as *causal* since individual characteristics, unobservable to the researcher, are likely to influence the education decision as well as labour market outcomes, and thus selection into unemployment might drive the results. Rather, our results should be understood as informative partial correlations, pointing out interesting patterns for recent years.

So far, research on the link between educational attainment and *unemployment duration* as well as wage penalties is scarcer and less conclusive than evidence on the relationship between education and the incidence of unemployment as well as a wide range of market and non-market outcomes (e.g. Card, 1999; Grossman, 2005). Whether education reduces the duration of unemployment and mitigates the effect of unemployment on wages is theoretically ambiguous and hence ultimately an empirical question: On the one hand, highly educated individuals should be in a better financial position and therefore able to

search longer for a higher quality job. On the other hand, individuals with lower wages are relatively better compensated by social benefits, so their search costs are lower.³

The paper provides new evidence on the link between educational attainment and unemployment duration for Germany and whether this relationship differs across age groups. To our knowledge, this link has not been studied for the time after the extensive German labour market reforms of the years 2003 to 2005, the so called Hartz reforms. There is strong evidence that these reforms had significant impacts on aggregate unemployment and earnings (see e.g. Fahr and Sunde, 2009; Krebs and Scheffel, 2013; Engbom et al., 2015), hence also individual employment durations and wage developments. Examining the most recent time span may yield different insights. Furthermore, we pay special attention to role of age, which has also been found to be a risk factor for long-term unemployment and the re-employment probability (e.g. Hunt, 1995; Lüdemann et al.; 2006, Lippmann; 2008; OECD, 2013). This is of particular interest as labour market participation among older workers has risen, encouraged by policy-making in the context of demographic ageing (e.g. the increase of the retirement age).

We complement the literature on the wage penalty of unemployment by focusing on the role of education. That is, we investigate whether educational groups experience different wage losses upon re-entering the labour market after a period of unemployment. Previous studies have established a robust link between unemployment and wages upon re-employment (e.g. Burda and Mertens, 2001; Placzek and Couch, 2010); however, the role of education has not been analysed in much detail. Both, general education and job-related skills can be expected to affect the ability to cope with unemployment, however, they might work differently. General education provides an important basis for human capital and is more easily transferable, as it has a value independent of the former job. In addition, general education can be addressed more directly by policy measures, whereas the acquisition of job-related skills is more often market-based. However, so far, the effects of job-related skills are more extensively studied.

Literature Review

Several existing studies provide tentative indication on the link between educational attainment and unemployment duration. In an empirical study on the UK, Nickell (1979) separates unemployment incidence as an inflow and duration component and analyses their respective relationships with educational attainment. The results indicate that while the level of education strongly influences the probability of becoming unemployed during working life, the duration of unemployment is rather weakly affected. Similarly, Mincer (1991) shows that education differentials in unemployment rates in the US are predominantly driven by the incidence of unemployment and not by duration of unemployment. Riddell and Song (2011a, 2011b) are among the first to account for potential endogeneity of education by exploiting different natural experiments in the US and Canada. They find robust evidence that higher education increases re-employment probabilities.

³ Other theoretical considerations are related to the relatively higher demand for skilled labour, particularly in times of skill shortages. In this case, the wage penalty due to unemployment should decrease with education. This could also be if unemployed well-educated individuals are better prepared and search more efficiently (e.g. Mincer, 1991). However, when displacement costs are driven by a loss of firm-specific rents or human capital, one should observe higher displacement costs for high educated workers (e.g. Schwerdt et al., 2010).

For Germany, most studies point to a positive relationship between education and exit out of unemployment, particularly in comparison to the least skilled individuals (Hunt 1995; Lüdemann et al., 2006, Winterhager, 2006). Along these lines, Lauer (2003) uses survey data from the German Socio-economic Panel (SOEP) for the years 1997 to 1999. She finds that the re-employment probability increases with education, with tertiary education providing the largest benefits. Based on the same data for West Germany from 1983 to 1997, Biewen and Wilke (2005) find that university education increases the probability of re-employment compared to vocational training. They also show that this pattern is less clear using administrative labour market data. In contrast to these results, Bender et al. (2002) find a marginally significant negative effect of education on the conditional probability of exit from non-employment for a sample of displaced workers in Germany between 1975 and 1990. None of these studies considers the time after the extensive German labour market reforms of the years 2003 to 2005.⁴

With regard to the consequences of unemployment periods on consecutive wages, the majority of existing evidence points to negative effects of both unemployment and unemployment duration. In their influential paper, Jacobson et al. (1993) find substantial negative wage effects for the US of up to 25 per cent per year for high-tenure workers. The earnings of displaced workers, who face an arguably more exogenous shock due to mass layoffs, drop more than the earnings of those who became unemployed for other reasons. This highlights the importance of selection into unemployment. They also show that the choice of the comparison group matters, as workers who remain in the same firm also face reduced wage growth. Couch and Placzek (2010), however, find lower effects than previous studies when using matching estimators that correct for systematic differences between workers. Using a differences-in-differences matching estimator, Hijtzen et al. (2010) show that displacements caused by firm closures and mass layoffs in the UK lead to income losses due to periods of non-employment, but small actual wage losses once employment is resumed. However, they also find that longer periods of non-employment lead to larger wage losses.

Using the SOEP from 1990 to 1996 for West Germany and exploiting information on plant closures, Couch (2001) reveals reductions in earnings that are at the lower end of the range of comparable US estimates. Burda and Mertens (2001) estimate an average displacement effect on wage growth of about 2 per cent for Germany, but losses seem to be larger and more comparable to US findings in the upper three wage quartiles. The wage penalty at higher quartiles is reduced if recalls are considered, which is interpreted as a reflection of firm-specific human capital.

Only a few studies focus explicitly on the impact of the unemployment duration on future wages in a setting comparable to the one implemented in this paper. Analysing voluntary and involuntary job losses together, Gregory and Jukes (2001) find that unemployment incidence has only a temporary effect. The effect of unemployment duration, by contrast, is permanent and strongest for older and better-paid men, with a one-year spell adding a further penalty of up to 10 percentage points. Taking a similar empirical approach to our study, Arulampalam (2001) finds no significant differences with respect to the length of the unemployment spell. Evidence for Germany confirms that longer periods of unemployment can be harmful (Bender et al, 2002; Fitzenberger and Wilke, 2010). In

⁴ There are several studies that deal with the effect of the Hartz reforms themselves and unemployment incidence or unemployment duration (see e.g. Caliendo et al, 2013, Amable and Françon, 2014 or Lo et al., 2017) but these studies do not focus on general education and unemployment duration.

addition, Bender et al. (2002) estimate that the slow job-finding penalty is smaller in the group of individuals who became unemployed because of a plant closure compared to those who became unemployed for other reasons.

To our knowledge, evidence on the relationship between educational attainment, age and the wage penalty of unemployment duration is limited. Most studies put more emphasis on job-related skills than on general education. Hijzen et al. (2010) show that initial losses after one year of unemployment are larger for skilled workers, which is consistent with the notion that firm-specific human capital and internal labour markets are important components of skilled workers' wages. Especially older workers are negatively affected. However, five years after re-employment, most of the differences across skill groups vanish. Analysing plant closures in Austria, Schwerdt et al. (2010) find that negative wage effects are particularly large for white-collar workers. Based on SOEP for the years 1984 to 2012, Toulemon and Weber-Baghdiguian (2017) find no clear differences in wage penalties between blue-collar and white-collar workers. Regarding age, the re-employment probability out of unemployment is lower for older workers, but there is no significant difference between age groups in terms of wage penalties of unemployment spells. For general education, on the other hand, there is some evidence by Couch (2001) that in West Germany each additional year of general education reduces the negative wage effect of job displacement by about one-third.

Data and Sample Selection

The dataset used in the analysis is the German Socio-Economic Panel (SOEP)⁵, a representative panel survey that started in the year 1984. The SOEP comprises information on approximately 12,000 private households and their members in both East and West Germany. The main questionnaire provides a rich set of socio-demographic variables including detailed information on employment-related issues (wages, occupation, and industry) as well as educational attainment on a yearly basis.

The SOEP features a retrospective monthly calendar that allows users to track individual employment histories.⁶ Based on this data, we construct spells of different types of labour market participation. We consider individuals to be employed if they are working full-time, part-time or have a mini-job (marginal employment). Individuals are defined as being unemployed if they are officially registered as unemployed.⁷ Furthermore, individuals are not participating in the labour force and are therefore considered inactive if they become homemakers, are on parental leave, in retirement or participate in further education.

⁵ Socio-Economic Panel (SOEP), data for years 1984-2016, version 33, SOEP, 2017, doi:10.5684/soep.v33.

⁶ This information may be subject to measurement error if individuals do not remember or do not report correctly whether or when exactly they were unemployed. For instance, the most common month in the data reported for the end of an unemployment spell is December (see also Hunt, 1995). However, unemployment increases in aggregate terms from November to December. The experienced painfulness of unemployment may also affect the reporting behaviour (e.g. Juerges, 2005).

⁷ Note that this does not exactly correspond to the ILO definition of unemployment that is often used as a standard in the literature. The information provided in the SOEP does not allow for it.

We define the following educational groups to examine varying effects across education levels:

- Formal qualifications: individuals without upper secondary degree – corresponding to ISCED 97 classification 0, 1, 2
- Upper secondary vocational qualifications: individuals with an upper secondary vocational degree– corresponding to ISCED 97 classification 3b and 3c⁸
- Post-secondary non-tertiary qualifications: individuals combining an upper secondary vocational degree following an academic upper-secondary degree (*Abitur*) – corresponding to ISCED 97 classification 4
- Vocational tertiary degree: corresponding to ISCED 97 classification ISCED 5b⁹
- Academic tertiary degree: corresponding to ISCED 97 classification ISCED 5a and 6

We restrict our sample to the years 2000 to 2016.¹⁰ We do so because in the year 2000 all individuals were questioned again about their highest education level. As a consequence, the information on educational attainment changed for a considerable number of individuals. To avoid variation in our education measures caused by these inconsistencies, all observations prior to 2000 are excluded.

Since the analysis is concerned with periods of unemployment and effects on subsequent wages, the sample is further restricted to individuals aged 25 to 55 years to exclude periods where individuals are either still in education or become eligible for (early) retirement.¹¹ In line with the majority of the literature on labour market outcomes, the analysis focuses on men only. To ensure representativeness and adjust for sample attrition, estimates are weighted using survey weights provided by the SOEP.

Even though we are able to control for a rich set of other variables, we cannot mimic an “experimental” setting. The data cannot be limited to displaced workers due to firm closure or downsizing. Hence, selection into unemployment cannot be ruled out and the estimated unemployment durations and wage penalties cannot be interpreted as the causal effect of the “treatment of unemployment”, but should be understood in terms of partial correlations only. Selection into unemployment can, for instance, depend on individual job prospects, past job performance or the economic situation of the previous employer. Therefore, if unemployment durations and wage penalties differ systematically between

⁸ Individuals with an education corresponding to ISCED level 3a are individuals who received a higher secondary diploma (*Abitur*) but no further education. An investigation of individuals who belong to this group in more detail reveals that they often work in occupations that actually require further education. Hence, in order to avoid problems that may arise due to misreporting, this group is excluded from the analysis.

⁹ This comprises the so-called “Meister” but also degrees of the so-called “Fachschule” in the former GDR. Individuals who got a training from a health care school and individuals with *Abitur* and civil service training are also included. The former GDR degrees make up a considerable share of observations in this educational group.

¹⁰ We checked whether the findings were strongly affected by the labour market reforms that were implemented in the year 2004. Dropping all waves prior to 2004 leaves us with similar results.

¹¹ As the analysis focuses on men, career breaks are more likely to be driven by labour market factors and not private, and possibly unobserved, factors.

those that have been unemployed and those who have been steadily employed, the estimated effects might be biased.

Sample selection for the duration analysis

The main variable of interest in the first part of the analysis is unemployment duration, which is derived from the retrospective monthly calendar information. The sample is comprised of individuals who were registered unemployed at least once between 2000 and 2016.

As the focus of our analysis lies on the examination of adjustment processes in response to an economic shock, we only consider unemployment periods following a period of employment. As a result, individuals who became unemployed prior to 2000 and those who were registered as unemployed after a period of inactivity are not considered. This definition ensures that all left-censored observations (i.e. observations without data on the exact beginning of an unemployment spell) are excluded. To proxy involuntary unemployment, we exclude unemployment spells following a termination of the contract by the employee. This is because individuals who voluntarily quit their job might already have another job lined up and do not enter into a phase of job search, which might bias the results.

Exits from unemployment may occur into employment (if a worker has found a new job) or into inactivity (if a worker withdraws from the labour force). We consider transitions from unemployment into both full-time and part-time employment, including mini-jobs. We control for individual background information reported at the beginning of an individual's unemployment spell.

As a result, the sample for the duration analysis consists of 3,449 unemployment spells experienced by 2,713 individuals. Descriptive statistics on the different transitions, the time spent in unemployment until a transition occurs, as well as the socio-demographic characteristics of the sample can be found in Appendix Table A1.

Sample selection for the wage analysis

For the analysis of wage developments in the second part of the empirical analysis, we use reported information on gross earnings in the month prior to the SOEP interview. Hourly wages are derived by dividing monthly earnings by the number of hours worked per month. Hours worked per month are obtained by multiplying average weekly working hours by 4.33. As the reported wages include overtime pay, actual hours worked and not the contracted hours are used in the analysis. Nominal wages in Euro are deflated using the consumer price index (CPI).

To identify whether individuals were unemployed prior to their current job, we again make use of the calendar data as well as information on the tenure with the current employer (reported in months). Based on these two sources, we can identify the starting date of the current job and the preceding labour-market status of the individual. Likewise, we can determine the duration of a previous unemployment spell. It should be noted that this information can only be identified for individuals who already participated in the SOEP and, hence, provided the calendar information when they started their current job.

For the years 2000 to 2016, we analyse 27,477 observations in total, of which 25 per cent experienced an unemployment spell prior to the current job. According to our definition 30 per cent of all observations with a prior unemployment spell are labelled as voluntary.

In order not to lose that many observations, we include both involuntary as well as voluntary unemployment spells in our main analysis. However, to check the robustness of our results, we also test for differences between these two types of spells.

Table 3 displays descriptive statistics of the sample used in the wage regressions. The simple, non-weighted average hourly wage of individuals without a previous unemployment spell is roughly 17.5 Euros, whereas it is only 13.4 for individuals who were previously unemployed. This simple difference, however, should not be interpreted as a wage penalty of unemployment, since unemployed individuals may differ from others in wage-relevant characteristics: For example, in terms of demographic characteristics, workers in the sample who were unemployed prior to their current job are more likely to live in East Germany, are less often married, and are slightly less likely to have children. When it comes to job-market related characteristics, they are more often employed in atypical employment such as part-time, temporary work or on fixed-term contracts and have less employment experience. Those that did not experience an unemployment spell prior to their current job have obtained a higher education level on average as already illustrated in Figure 1. The two groups are only similar in terms of age and nationality. Overall, the differences between these two groups point to the issue of selection discussed above and highlight the importance of including individual fixed effects and controlling for confounding factors in the econometric analysis later on.

Unemployment Duration and Educational Attainment in Germany

In this section, we analyse the link between the probability of re-entering employment and educational attainment. In a first step, we present descriptive evidence on unemployment durations of different educational groups. To this end, we plot Kaplan-Meier estimates of the non-parametric survival functions of unemployment spells following a job loss. We only investigate transitions to employment; spells ending in a transition to inactivity are treated as censored for this descriptive analysis.¹² In a second step, we investigate the link between unemployment duration and education in more detail by estimating discrete time competing risk models that also explicitly consider the possibility of leaving the labour force.

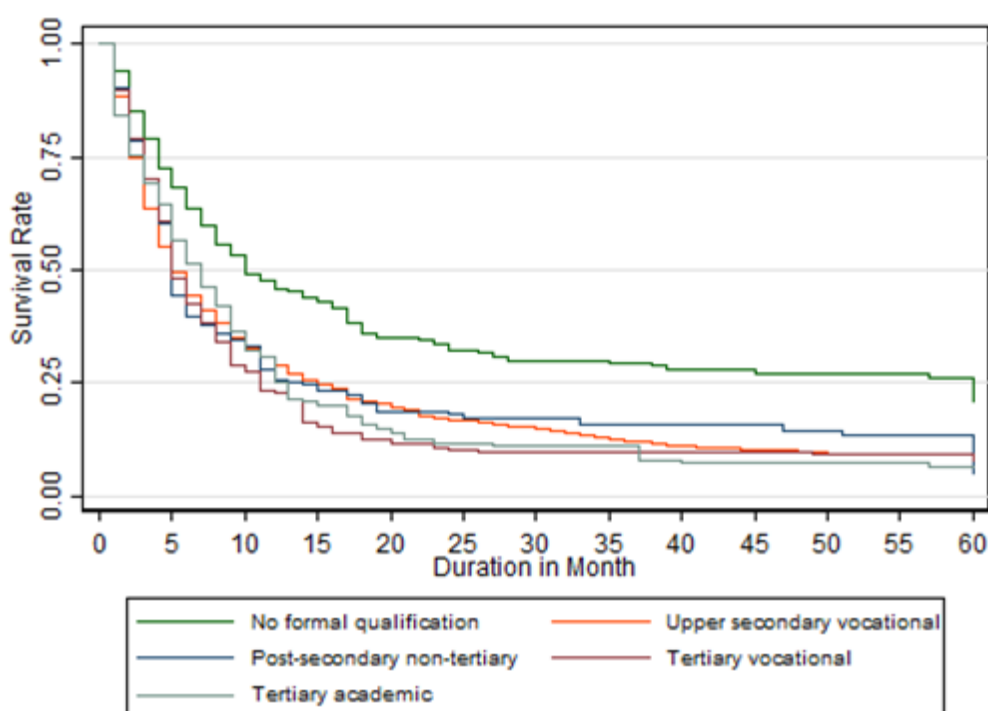
Descriptive Results

Kaplan-Meier survival curves indicate the probability of still being unemployed after a given duration in unemployment. Figure 2 depicts separate curves for different education levels. For the graphical representation, the curves are cut at 60 months. Several facts are apparent in this graph. First, the different curve progressions indicate that once workers have become unemployed, individuals without formal qualifications find it much harder to re-enter employment than the unemployed with a higher level of education. While half of the unemployed individuals in these groups exit unemployment within five to seven months, the median survival time, i.e. the time spent unemployed for individuals without formal qualifications amounts to ten months.

¹² Due to the nature of the survey data employed in this analysis, some observations are right-censored, i.e. unemployment spells are incompletely observed because individuals drop out of the survey before they exit from unemployment into another state.

It is somewhat surprising that, at short unemployment durations, individuals with an academic tertiary degree leave unemployment at a slightly slower rate compared to the other groups with at least some formal qualifications. On the one hand, this finding might reflect that individuals with an academic tertiary degree disproportionately profit from a better job match and are on average less financially constrained. On the other hand, the observation hints to a potential selection issue: As the survivor functions do not consider differences in the characteristics of the populations, it may be that the subsample of highly educated unemployed features characteristics that make finding a new job harder after separation. Hence, these workers would take longer to find a new job independent of their educational attainment. However, a test for differences of the survivor functions based on the likelihood of a Cox proportional hazard model indicates that, even though small differences are visible, unemployment durations do not differ significantly between most educational groups, except from the one without formal qualifications.

Figure 2. Survival Rate by Education

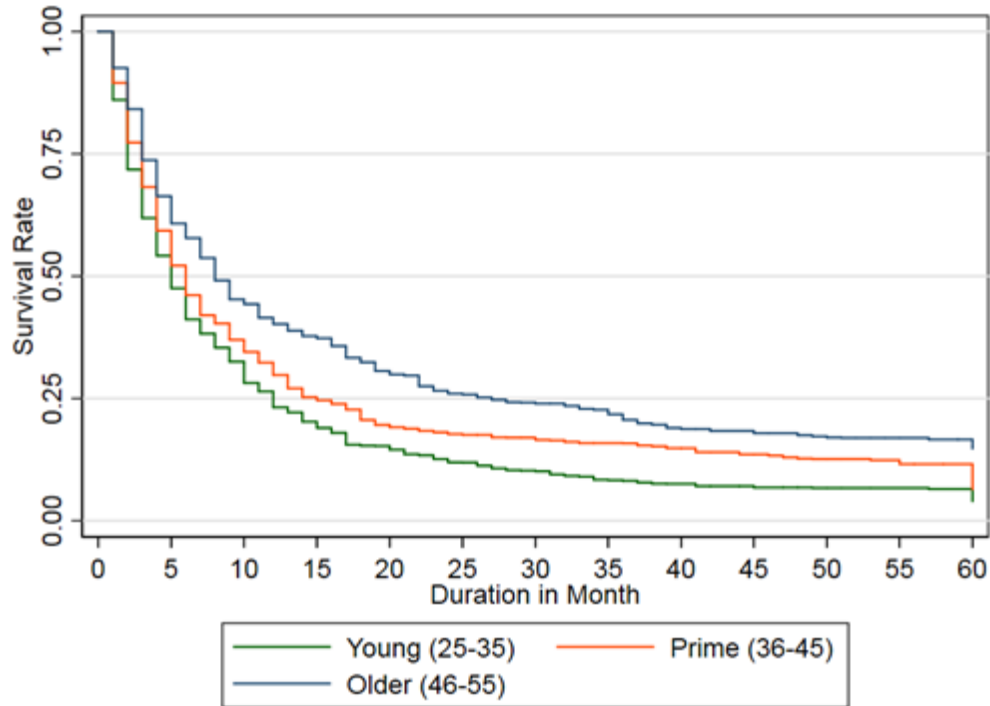


Age is often found to be negatively related to the re-employment probability (e.g. OECD, 2013). Age-related differences can reflect different factors such as the depreciation of human capital (Becker, 1962) and mobility constraints of older workers (Greenwood, 1997), which make it harder to re-enter employment.

In order to investigate potential heterogeneity in unemployment durations with respect to age, we stratify the overall sample into three different age groups (25-35, 36-45 and 46-55 years), where the stratification is based on the age at the beginning of a respective unemployment spell. The Kaplan-Meier curves depicted in Figure 3 indicate that unemployment duration increases monotonously with age. While half of the unemployed individuals in the two younger age groups find a new job within five to six months, the median survival time for the oldest group amounts to eight months. Interestingly, the differences in unemployment durations between the age groups grow larger at higher

percentiles of the duration distribution, indicating that older individuals have a higher risk of becoming long-term unemployed: the number of months until at least 75 per cent of the older unemployed re-enter employment amounts to 27, while for the two younger groups it takes twelve and 15 months, respectively.

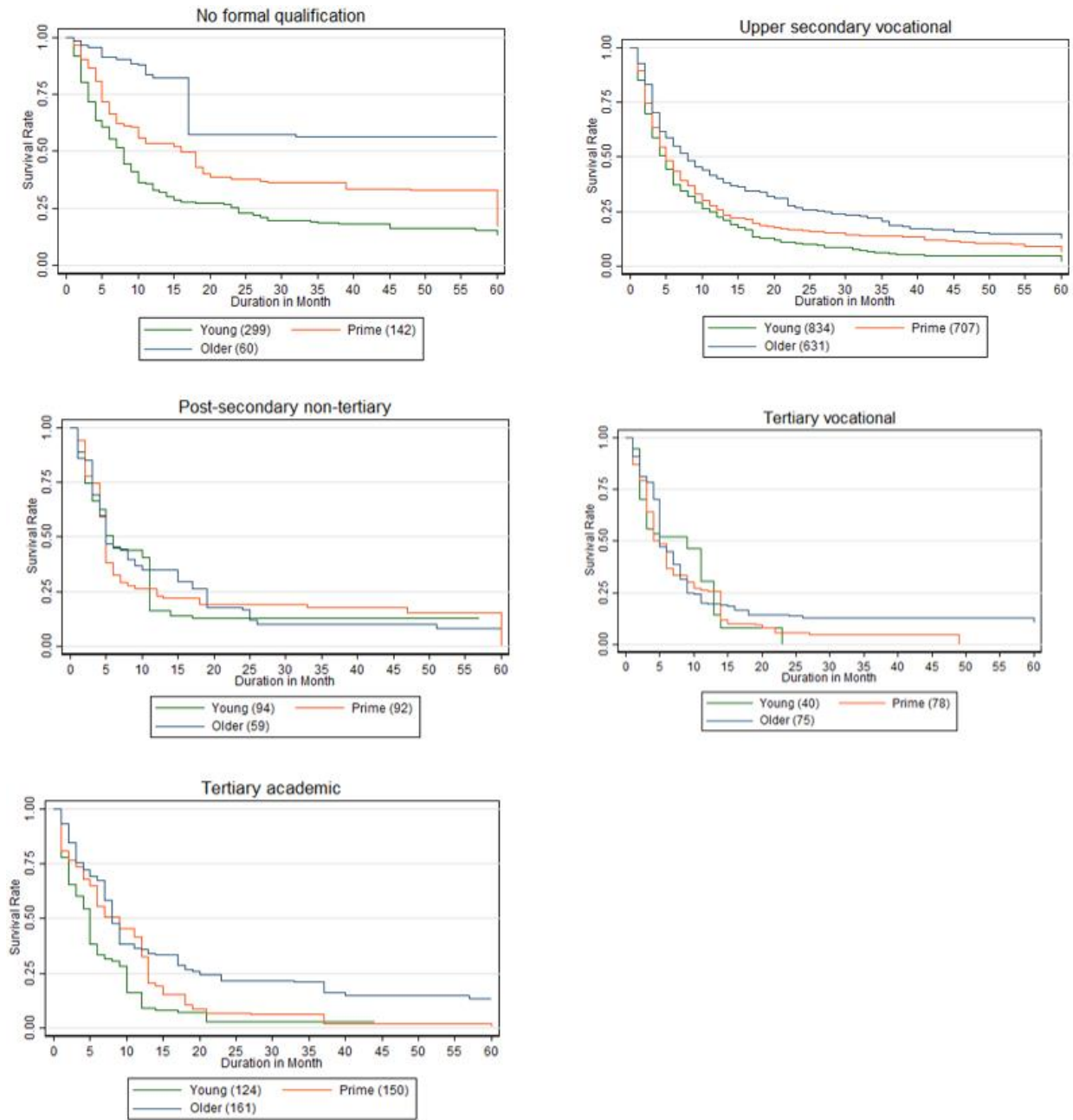
Figure 3. Survival Rate by Age Group



Finally, Figure 4 shows age-specific survival rates stratified by educational attainment. The positive relationship between age and unemployment duration holds for individuals of all education levels. Yet, age-specific differences are particularly large for workers without formal qualifications: While 50 per cent of the young unemployed re-enter employment within eight months, the prime-aged unemployed take a median of 16 months. Less than 50 per cent of the older unemployed individuals without formal qualifications find a job at all. Thus, the risk of long-term unemployment appears to rise relatively strongly with age for low-educated individuals, but there is also a clear pattern for workers with an upper secondary vocational degree, where the unemployment duration is higher above the age of 45 years. The 75th percentile of older workers from this education group only re-enters employment after 27 months.¹³ Also in the group of individuals with an academic tertiary degree, the difference between younger and older workers is pronounced, especially at longer unemployment durations.

¹³ Table A2 summarises specific percentiles of the survival curves across age groups for university graduates as well as graduates with an upper secondary vocational degree to illustrate the longer unemployment durations for older workers. For example, the median survival duration for individuals with an upper secondary vocational degree is five months for 25 to 35-year-olds compared to eight months for workers between the ages of 46 and 55 years.

Figure 4. Survival Rates by Age and Educational Attainment



Note: Numbers in parentheses refer to the number of unemployment spells in each age-education group. Young workers are 25 to 35 years old, prime aged workers are 36 to 45 years old and older workers are 46 to 55 years old.

Competing Risk Analysis

Empirical Strategy

The survivor curves already highlight education-specific as well as age-specific differences in unemployment durations. To analyse these relationships in more detail, we estimate discrete time competing risk models. These models are widely used in empirical studies of unemployment durations and offer two advantages: First, it is possible to compute survival probabilities that are adjusted for individual characteristics. Second, these models do not only estimate the probability of a transition to a new job, but simultaneously control for transitions into inactivity. The purpose of this analysis is, hence, to check whether the patterns found from the simple survival curves also hold when controlling for additional variables and for transitions into inactivity.

We model the duration in unemployment as a discrete spell, measured in months, where the spell ends when an individual transits either into employment or into inactivity. In the spirit of e.g. Steiner (2001), we model the two transitions as discrete state-specific hazard rates

$$\lambda_{ij}(t|x_i(t), \varepsilon_{ij}) = P[T_i = t, \Omega = j | T_i \geq t, x_i(t), \varepsilon_{ij}], \quad (1)$$

with $i = 1, 2, \dots, n$; $j = 1, 2$;

$x_i(t)$ = vector of covariates of individual i at time t

$\Omega = 1$, if transition into employment

= 2, if transition out-of-the-labour-force

ε_{ij} = transition-specific error terms, assumed to be conditionally independent and normally distributed with zero mean.

The conditional independence assumption on the error terms allows us to treat employment and inactivity as competing risks to model the probability of a transition into either of the two states j in period t as

$$P(T = t, \Omega = j | x_i(t), \varepsilon_{ij}) = \lambda_j(t|x_i(t), \varepsilon_{ij}) \prod_{\tau=1}^{t-1} (1 - \lambda_j(\tau|x_i(t), \varepsilon_{ij})), \quad (2)$$

the product of the transition period t and the survivor function up to time $t-1$. Following Allison (1982) and Jenkins (1995), the model is estimated using a multinomial logit with unemployment as the base category and employment and inactivity as two mutually exclusive choices. This leads to the following specification of the hazard rates

$$\lambda_{ij}(t|x_i(t), \varepsilon_{ij}) = \frac{\exp(\alpha_j(t) + \beta'_j x_i + \varepsilon_{ij})}{1 + \sum_l \exp(\alpha_l(t) + \beta'_l x_i + \varepsilon_{il})}, \quad (3)$$

where $\alpha_j(t)$, the so-called baseline hazard, describes the dependence of the hazard rate on the time elapsed since the beginning of the unemployment spell for the reference group. The vector x_i contains variables that are measured at the beginning of the unemployment

spell and are held fixed over the unemployment duration. As we are interested in the relationship between educational attainment and age with respect to unemployment transitions, x_i contains indicator variables for the five different educational categories and the three different age groups. We specify the group without formal qualifications and the youngest age group (age 25-35 years) as the reference category. Thus, the estimated coefficients indicate the differential effects on the hazard rate compared to someone who belongs to these two groups. In our most extensive specification, x_i also contains a large set of control variables, namely the year of the start of the unemployment spell, socio-demographic factors (indicator variables for marriage, children and their age structure as well as for East German residence) and a set of indicators for the type of the last job.

Estimation is based on the sample likelihood function, which is given by:

$$L = \prod_{i=1}^n \prod_{j=1}^2 [\lambda_j(t|x_i(t), \varepsilon_{ij})]^{\delta_{ij}} \prod_{\tau}^{t-1} ((1 - \lambda_j(\tau|x_i(\tau), \varepsilon_{ij}))^{c_i}), \quad (4)$$

where δ_{ij} is an indicator equal to one if the unemployment spell of individual i ends in state j and c_i is an indicator equal to one, if the unemployment spell of individual i is right-censored, which could either be at the end of the observation period, or because of sample attrition, which is assumed to be random.

Results

Unemployment Duration by Education and Age

Table 1 reports the results from estimating different variations of Equation 4 including all age and educational groups. Each column contains two sets of coefficients: The first set contains the coefficients for the probability of a transition to employment; the second set contains the coefficients for a transition into inactivity. The specification in Column 1 only includes the most basic indicator variables for the educational and age groups of interest. In Columns 2 to 4, the model is step-by-step augmented by covariates. Column 2 additionally includes time fixed effects (measured in the year of the beginning of the unemployment spell); Column 3 adds socio-demographic variables. Finally, Column 4 additionally contains a set of indicators for the type of the last job.

Overall, the estimated coefficients confirm the patterns found in the survivor curves in Figure 2 and Figure 3. Individuals without formal qualifications – the base category – find it significantly harder to re-enter employment compared to those with any kind of formal qualifications. The magnitude of the point estimates on the two tertiary educational groups is somewhat larger than for the two groups with non-tertiary vocational degrees, suggesting that tertiary education is related to higher re-employment probabilities. However, a test for statistical differences between the individual coefficients does not corroborate this conjecture, as none of them is statistically different from any of the others. This is also in line with the graphical evidence from Figure 2, where the empirical survivor curves are virtually not distinguishable from each other, apart from the one for those without formal qualifications.

The last two rows of Table 1 also contain the coefficients for the two age-group dummies, which confirm the patterns from Figure 3: The older an individual, the less likely is a

quick transition into a new job. The difference between prime-age and older individuals is statistically significant.

The coefficients from the hazard rate into inactivity do not produce any strikingly significant results. These results suggest that there are no clear differences across educational attainment and age regarding the choice to drop out of the labour force.

Considering the different model specifications in Columns 1 to 4, the estimates on the variables of interest remain robust to the inclusion of further control variables. In all four columns, the baseline hazard is specified as $n(t)$. In order to check whether this rather simple parameterization is too restrictive, we re-estimate the fully specified model from Column 4 for different specifications of the baseline, namely a quadratic or a cubic polynomial and a highly flexible non-parametric baseline, based on dummies for every month after job loss. The results appear to be very robust with respect to the chosen parameterization (see Table A3).

Taken together, the estimation results suggest that education enhances re-employment probabilities, but that the specific type of formal education does not play a dominant role. The poor showing of the group without any formal education and similar general patterns of re-employment have been documented in previous duration studies for Germany (e.g. Lauer, 2003; Biewen and Wilke, 2005) before the Hartz reforms in 2005; however, we do not find significantly quicker transitions for highly educated people compared to any other form of formal education. After the Hartz reforms, which were mostly targeted on low-skilled individuals, education-specific unemployment rates in Germany have converged (see Figure 1). This development might not only be a matter of inflow into unemployment but also a result of decreasing unemployment durations of low- and medium-educated workers.

Age-specific Effects of Education

To investigate the combined effects of education and age, we re-estimate the fully specified model separately for each educational group.¹⁴ The results displayed in Table 2 correspond to the descriptive survivor curves in Figure 4 and again confirm the graphical evidence. The coefficients for the transition into employment show that age-specific differences are particularly large for workers without formal qualifications (Column 1). One reason for these relatively large, statistically significant differences in re-entering employment may be that low-skilled jobs often require the performance of manual tasks (Autor and Dorn, 2011), where older workers have productivity disadvantages.

As indicated in Column 2, age-specific differences in unemployment durations are also present for individuals with a vocational upper secondary degree. While also many medium-skilled workers are subject to considerable physical demands, a further explanation for these patterns may be related to technological change: As shown for example by Autor et al. (2003) for the US and Spitz-Oener (2005) for Germany, technological advancements have mainly affected medium-skilled workers, who tend to perform routine tasks, which are prone to substitution by machines. This technology-induced substitution has been particularly pronounced for older workers (Senfleben and Wieland, 2014), resulting in a lower probability of re-entering employment after a period of unemployment.

¹⁴ The model is based on the specification in Column 3 in Table 1, i.e. without job type information in order to guarantee convergence for all five sub-groups.

The small and insignificant point estimates in Columns 3 and 4 indicate that workers with post-secondary non-tertiary qualifications or with a tertiary vocational degree do not feature age-specific differences in unemployment durations. In contrast, an academic degree does not fully attenuate the negative effects of age on the probability of re-entering employment (Column 5).

While there were no significant and striking patterns for the transition into inactivity in the overall sample in Table 1, the analysis stratified by educational attainment provides some interesting insights: For those without any formal qualifications, individuals from the prime-aged group are much less likely to drop out of the labour force compared to their younger and older peers. There are also mildly significant coefficients of the interaction terms of the prime-aged and older group of individuals with a tertiary vocational degree. However, these results should be interpreted carefully, given the small sample size and the very low frequency of transitions out of the labour force for these subgroups.

Overall, our results suggest that education might be an important means to mitigate the negative consequences of unemployment. Having a vocational or a tertiary degree is strongly related to higher re-employment probabilities. However, once any kind of qualification is obtained, our results point to no significant differences between education levels. Furthermore, older workers take particularly long to find a new job after an unemployment spell, where this result is mainly driven by the workers without upper secondary education. These patterns should not be interpreted as *causal* effects since neither variation in educational attainment, nor the event of unemployment are truly random. The significantly worse performance of individuals without any formal qualifications, however, highlights the importance of education in the labour market. Also, the results on the longer durations for older workers possibly make a case for lifelong learning opportunities especially when preparing the work force for the digital transformation.

Unemployment and Subsequent Wages

In this section we investigate the consequences of unemployment once employment is resumed. Specifically, we analyse whether periods of unemployment lead to a wage penalty when re-entering employment, a phenomenon often referred to as “wage scarring”. As in the previous section, we investigate whether wage penalties differ between educational groups and between younger and older workers.

Empirical Approach

In order to estimate the relationship between wages and preceding unemployment spells, we follow Arulampalam (2001) and define two main groups: First, workers who started a new job without a preceding period of unemployment, and second, workers who did experience a period of unemployment prior to their current job. The first group serves as a control group for the latter and allows us to separate the influence of unemployment from other wage determinants.¹⁵

¹⁵ We compare previous unemployed individuals with workers who have been continuously employed but *not* with the same employer. Hence, individuals in our control group also switch jobs. In contrast, many of the cited papers above do not explicitly differentiate between continuous employed individuals staying employed with the same employer and those switching firms.

We estimate the following general wage equation for individuals who report a positive wage at the time of the interview.¹⁶

$$y_{it} = \beta_1 \text{prev_unemployment}_{it} + X'_{it}\beta_2 + \alpha_i + \varepsilon_{it} \quad (4)$$

where y_{it} is the logarithm of the real hourly wage of individual i at time t . Episodes of preceding unemployment are captured using two different approaches. In the first approach, $\text{prev_unemployment}_{it}$ is a simple dummy variable, which is equal to one if the individual entered the current job out of unemployment of at least one month and zero otherwise. This definition might lead to downward-biased results if a lot of individuals who are in-between jobs register as unemployed for a very short time in order to receive health care coverage. Hence, in a second approach, we instead use the actual number of months spent in unemployment prior to the current job ($\text{prev_unemployment}_{it}$). It is equal to zero if the individual was not unemployed. Using the duration measure is, hence, more precise and directly links this part of the analysis to the duration analysis conducted in the previous section. Consequently, the parameter β_1 measures either an average wage penalty in a job following unemployment in general or the average wage penalty of one additional month of unemployment.

The panel character of the SOEP allows us to include individual fixed effects (α_i) in the regression in order to capture time-invariant individual differences. The main idea of this specification is to compare the change in wages for the same individual (“within” an individual). Furthermore, we include year fixed effects, dummies for the month of the interview to capture any seasonal effects and dummies for the year in which the current job was taken up. The latter is supposed to control for any permanent effects that can be traced back to the macroeconomic conditions that prevailed when the individual started working with the current employer. This means that we analyse whether wage rates develop differently for individuals who experience a period of unemployment compared to individuals who do not experience such an unemployment spell. The error term ε_{it} is clustered at the individual level to correct for possible serial correlation of the error term.

In order to control for as many confounding factors as possible, a matrix of control variables (X'_{it}) is included. This matrix consists of controls for socio-demographic characteristics such as age, age-squared, marital status, dummies for children of different ages, and a dummy for East German residence. Furthermore, we control for education-specific age-wage profiles by interacting age and age-squared with dummies for the different education levels. We also control for employment experience combining information on full-time as well as part-time in a single measure ($\text{experience} = \text{exp_full} + 0.5 * \text{exp_part}$) and add an indicator variable for any prior unemployment spells that are not captured by our main explanatory variable. Information on the current job such as tenure in the job, industry dummies, a part-time dummy, dummies for the type of occupation (e.g. blue-collar), temporary work or fixed-term contracts is included as well. To ensure that outliers do not drive our results, we set extreme wage outliers to the lowest and highest one per cent of the wage observations respectively (winsorising)¹⁷ and exclude

¹⁶ Since for self-employed individuals it is difficult to derive an hourly wage in general, these individuals are excluded from the sample.

¹⁷ This is a standard procedure to avoid results that are driven by extreme, non-representative or unreasonable data points. There are a few very low and very high values. For example, the lowest one per cent of wage observations are at or below three euros. This might be an issue of mismeasurement due to the fact that hourly wages are not directly observed but have to be derived by using information on the hours worked per week.

observations with a preceding unemployment spell of more than five years, which applies to about one per cent of all observations.

Even though we control for individual fixed effects and a rich set of other variables, we cannot mimic an “experimental” setting. The data do neither allow us to focus on displaced workers due to firm closure or downsizing only. Hence, selection into unemployment cannot be ruled out and the estimated wage penalties cannot be interpreted as the causal effect of the “treatment of unemployment”, but should be understood in terms of partial correlations only.¹⁸ It also should be noted that it is not possible to draw any conclusions for those who remain unemployed or who drop out of the labour force, since the estimation only includes the selected group of individuals who have returned to employment.¹⁹

Results

Average Wage Penalty

Table 4 reports the results from estimating different variations of Equation 4. Panel A displays the results for the specification that includes a dummy for previous unemployment as the main explanatory variable. Panel B includes the continuous unemployment duration measure instead. The specification in Column 1 includes time and individual fixed effects only, Column 2 adds demographic characteristics. Information on the employment history and job experience is added in Column 3. Finally, the regression reported in Column 4 additionally controls for job characteristics as described above.

Overall, the coefficient for unemployment, using either definition, is negative and statistically significant in all specifications. For example, the point estimate in Column 4 of Panel A implies that wages of workers with a preceding unemployment spell are 3.5 per cent lower compared to individuals with an employment-to-employment transition. Note that this difference is much smaller than the difference in mean wages of individuals with or without a previous unemployment spell (Table 3). This indicates that selection into unemployment is not random and that other characteristics correlate with the unemployment status. The coefficient on the duration measure in Column 4 of Panel B translates into a wage penalty of 0.42 per cent per month of unemployment or 5.1 per cent per year of unemployment. Quantitatively, these effects are smaller than previous comparable findings from the literature. For men in the UK, Arulampalam (2001) finds a wage penalty of about 7 per cent over the period from 1991 to 1997 and Gregory and Jukes (2001) estimate a negative effect of 0.8 per cent per month of unemployment for the years between 1984 and 1994. Compared to evidence from the US, our results are

¹⁸ Selection into employment might depend on individual job prospects, past job performance or the economic situation of the previous employer, and thus might still influence (and bias) our results if the wage penalty is heterogeneous and systematically differs between those that have been unemployed at one point and those who are never unemployed, even when individual fixed effects are controlled for. We also do not explicitly control for the possibility that wages might begin to decrease even before unemployment. Theoretically, this could lead to an underestimation of the wage penalty. However, since wages are observed at the time of interview, which does not necessarily correspond to the period right before unemployment, this might not be an important issue in this analysis.

¹⁹ We do not employ the Heckman correction procedure for selection into employment, due to the lack of a credible and valid exclusionary restriction. A robustness check with a Heckman correction identified using the non-linearity of the employment status only leaves the estimated coefficients of the wage regressions essentially unchanged.

particularly low. However, as discussed in the literature review, previous studies have shown that wage penalties in Germany are in general at the lower end of the distribution of wage effects across countries.

The magnitude of the coefficients decreases with the inclusion of additional explanatory variables, with the biggest jump occurring when labour market experience is controlled for. The signs of the coefficients on experience, unemployment and job tenure are as expected (not shown): More experience is associated with a higher wage; additional spells of unemployment with a lower wage. The decrease in magnitude of the estimated relationship between preceding unemployment and wages may reflect that individuals who experienced an unemployment period prior to current job are in general less attached to the labour market. Hence our estimate may partly pick up general differences in relevant education and experience. The coefficients decrease further when including job characteristics (Column 4). This suggests that part of the detected wage penalty reflects the fact that previously unemployed individuals re-enter into lower quality jobs compared to the job before the unemployment period. This interpretation is in line with the findings on job quality by Couch (2010), as described above.²⁰

Column 4 controls for the full set of individual characteristics and therefore represent the most conservative estimates of a wage penalty and will serve as our preferred one for the rest of the analysis. As described in the previous section, unemployment duration varies to some extent across different groups. Therefore, when analysing differences in the pattern with respect to age and education, we focus on the specification that includes unemployment duration as the variable of interest.

The analysis so far has focused on unemployment periods following voluntary as well as involuntary job terminations. It is possible that individuals with higher education quit their job more often voluntarily while having another job already lined up, which could lead to a smaller or non-existing wage penalty. However, defining involuntary job terminations as in the duration analysis and interacting an indicator variable with the duration measure does not show significantly different wage penalties between voluntary and involuntary unemployment (not shown).²¹

Results by Education and Age

We augment the baseline model described by Equation 4 by interaction terms between previous unemployment duration and dummies for the five educational groups and depict the results in Table 5. For ease of comparison, the baseline estimates for the average wage penalty are reproduced in Columns 1 and 3, respectively. The estimates of our preferred

²⁰ Interestingly, given a spell of unemployment, the quality of a newly found job could also increase with unemployment duration: the longer an unemployed individual searches for a new job, the better the match and, hence, the higher the job quality could be. For example, Caliendo et al. (2013) show that longer periods of unemployment benefits increase unemployment duration, but at the same time lead to higher quality jobs once employment is resumed. Including dummies for different length of unemployment (not shown), however, does not yield a similar finding for our sample. The coefficients on those dummies increase with the length of the unemployment duration, confirming our results when using a simple linear measure of unemployment duration.

²¹ If anything, wage penalties for involuntarily unemployment seem a little smaller in size. This also holds true for individuals with an academic degree. This is in line with Arulampalam (2001), who finds lower wage penalties for involuntarily laid-off workers, and Bender et al. (2002), who find smaller penalties for unemployment after firm closure.

specification in Column 4 indicate that the magnitudes of the coefficients for different educational groups vary. The impact of unemployment duration on wages of individuals with upper secondary vocational qualifications and workers without formal qualifications is statistically significant. The coefficient for individuals with an academic degree is the smallest. The estimate of only 0.23 per cent per month of unemployment for this group is half of the average penalty across all education levels (Column 3). However, testing for the difference between the coefficients for different education levels reveals that none of them is statistically different from any of the others.²² This stands somewhat in contrast to findings by other studies that show a higher wage penalty for skilled individuals (e.g. Hijzen et al., 2010) or for workers in the upper part of the wage distribution (e.g. Burda and Mertens, 2001).²³ The difference in findings might be explained by the fact that we analyse general education in comparison to job-related skills, as the latter get lost if workers are displaced. Moreover, the loss of firm-specific knowledge might materialise with every change of employer. The fact that our control group consists of individuals who also changed their job but did not experience a period of unemployment in between might explain the difference compared to other studies. Additionally, the German labour market was mostly in an excellent condition in our sample period, which could make the loss of firm-specific capital less relevant compared to previous times.²⁴

Analogous to the analysis of unemployment duration, we investigate age differences. Table 6 reports results from a regression where the two respective unemployment measures are interacted with three age dummies.²⁵ Different from the estimation in Table 5, the coefficients for the age groups measure the difference in comparison to the estimate for the reference age group comprising individuals aged 25 to 35 years. Controlling for unemployment by a simple unemployment dummy, the estimates suggest a significant wage penalty for individuals aged 46 to 55 years that is 4.6 per cent higher than for both, individuals aged between 25 and 35 years as well as prime-age men. When including the continuous duration measure, however, the differences between the age groups are not significant anymore (cp. Column 1 and Column 2). This result suggests that it is not the age *per se* that is associated with a higher wage penalty of unemployment but rather the time spent in unemployment. Hence, the significant differences in Column 1 are likely to reflect that older individuals tend to experience longer unemployment durations on average rather than the effect of age itself, which is confirmed by the results presented in the duration analysis.

²² Results are presented in Table A4. We also investigated the same specifications as displayed in Table 4 by subsequently adding different explanatory variables to the education regressions. The results are qualitatively similar to those presented for the average wage penalty across all education levels (shown in Table A5 in the Appendix).

²³ In contrast, Couch (2010) estimates that an additional year of general education, which corresponds more closely to our measure of human capital, reduces the negative wage effects of job displacement in Germany.

²⁴ The analysis uses unemployment periods following voluntary as well as involuntary job terminations, thus our estimates could be biased by selection effects. However, dropping voluntary job terminations from the sample does not lead to more pronounced wage penalties in general.

²⁵ Table A6 displays descriptive statistics for the different age groups in terms of education and average wages.

Conclusion

This study analysed the relationship between educational attainment and the consequences of unemployment for Germany, using recent survey data for the years 2000 to 2016. Our results indicate that individuals without any formal qualifications experienced significantly longer unemployment spells compared to individuals with any kind of vocational or academic education. We do not find any evidence for significant differences across educational groups, once any type of formal education is considered. Older workers find it somewhat more difficult to re-enter employment in general. This again seems to be particularly the case for low-educated individuals. Our results on wage penalties of unemployment spells indicate that time spent in unemployment bears a material cost to workers even after employment has been resumed. Variations in these penalties across workers seem mostly driven by the unemployment duration and less so by other factors such as age or education. The results demonstrate that education in general is a valuable means to handle individual shocks in the labour market. With the on-going process of digitalisation probably entailing some amount of turnover in the labour market, the attainment of formal education levels will prove beneficial in order to adapt to possible changes. The results on the particular vulnerability of older workers might also hint towards the importance of life-long learning possibilities, which again might become more crucial as the digital transformation progresses.

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Tables – Main Text

Table 1. Competing Risk Employment and Inactivity

	(1)		(2)		(3)		(4)	
	Employment	Inactivity	Employment	Inactivity	Employment	Inactivity	Employment	Inactivity
Upper Secondary Vocational	0.634***	-0.136	0.650***	-0.159	0.635***	-0.354	0.589***	-0.440*
Post-Secondary Non-Tertiary	(0.104)	(0.248)	(0.104)	(0.243)	(0.107)	(0.245)	(0.106)	(0.260)
Tertiary Vocational	0.565***	0.508	0.573***	0.546	0.584***	0.366	0.649***	0.415
Tertiary Academic	(0.158)	(0.415)	(0.161)	(0.428)	(0.163)	(0.450)	(0.164)	(0.445)
Age 36 - 45	0.881***	0.137	0.856***	0.0944	0.767***	-0.00783	0.724***	-0.0202
Age 46 - 55	(0.178)	(0.448)	(0.179)	(0.458)	(0.177)	(0.464)	(0.177)	(0.520)
Baseline	ln(t)		ln(t)		ln(t)		ln(t)	
Year Fixed Effects			✓		✓		✓	
Demographics					✓		✓	
Job Characteristics							✓	
N. of Spells	3,449		3,449		3,449		3,449	
AIC	64,842,280		64,582,974		64,339,913		63,903,667	
BIC	64,842,416		64,583,363		64,340,386		63,904,309	
NxT	34,526		34,526		34,526		34,526	

Note: All effects relative to the base category “no formal qualifications; Age 25-35.

Clustered standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 2. Competing Risk – Effects within Educational Groups

	(1)		(2)		(3)		(4)		(5)	
	No formal qualification		Upper Secondary Vocational		Post-Secondary Non-Tertiary		Tertiary Vocational		Tertiary Academic	
	Employment	Inactivity	Employment	Inactivity	Employment	Inactivity	Employment	Inactivity	Employment	Inactivity
Age 36 - 45	-0.603** (0.252)	-2.067*** (0.665)	-0.280*** (0.105)	0.0343 (0.357)	-0.108 (0.349)	-0.691 (0.983)	-0.248 (0.506)	-1.880* (1.142)	-0.497 (0.312)	0.163 (0.686)
Age 46 - 55	-1.862*** (0.520)	-0.543 (0.502)	-0.719*** (0.111)	-0.567 (0.362)	-0.213 (0.470)	-1.444 (1.331)	-0.648 (0.443)	-1.757* (1.059)	-0.847*** (0.320)	0.872 (1.009)
Baseline	ln(t)		ln(t)		ln(t)		ln(t)		ln(t)	
Year Fixed Effects	✓		✓		✓		✓		✓	
Demographics	✓		✓		✓		✓		✓	
N. of Spells	490	2,115	240	192	412	490	2,115	240	192	412
AIC	8,385,842	40,056,585	3,536,989	3,343,810	7,483,538	8,385,842	40,056,585	3,536,989	3,343,810	7,483,538
BIC	8,386,168	40,056,967	3,537,260	3,344,067	7,483,832	8,386,168	40,056,967	3,537,260	3,344,067	7,483,832
NxT	6,684	20,819	2,095	1,549	3,379	6,684	20,819	2,095	1,549	3,379

Note: All effects relative to the base category age 25-35.

Clustered standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 3. Descriptive Statistics for the Scarring Analysis

	Workers without unemployment spell prior to current job	Workers with unemployment spell prior to current job
	Mean(St. Dev.)	Mean(St. Dev.)
Age	39.31 (8.01)	39.17 (8.37)
No Formal Qualifications	0.07	0.11
Upper Secondary Vocational	0.41	0.56
Post-Secondary Non-Tertiary	0.09	0.06
Tertiary Vocational	0.11	0.08
Tertiary Academic	0.32	0.20
East	0.20	0.34
German	0.91	0.90
Married	0.68	0.60
Young Children	0.15	0.13
Middle-Aged Children	0.17	0.16
Old Children	0.39	0.35
Work Experience	16.78(8.78)	16.26(9.14)
Part Time	0.04	0.05
Temporary Work	0.02	0.06
Fixed-Term Contract	0.10	0.15
Hourly Real Wage	17.61 (10.08)	13.40 (7.71)
N. of Obs.	20,435	7,042

Note: Observations pooled one observation per worker per year, not weighted.

Table 4. Wage Penalty of Unemployment

Panel A: Unemployment Dummy				
	(1)	(2)	(3)	(4)
Unemployment	-0.051*** (0.0156)	-0.049*** (0.0151)	-0.039** (0.0151)	-0.034** (0.0148)
Panel B: Unemployment Duration in Months				
	(1)	(2)	(3)	(4)
Unemployment	-0.0058*** (0.0013)	-0.0053*** (0.0013)	-0.0044*** (0.0013)	-0.0042*** (0.0013)
Individual & Time FE	✓	✓	✓	✓
Demographics		✓	✓	✓
Employment Experience			✓	✓
Job Characteristics				✓
N. of Obs.	27,477	27,477	27,477	27,477
R-squared	0.851	0.857	0.858	0.860

Note: Clustered standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 5. Wage Penalty by Educational Group

	(1) Unemployment Dummy	(2) Unemployment Dummy	(3) Unemployment Duration	(4) Unemployment Duration
Unemployment	-0.034*** (0.0148)		-0.0042** (0.0013)	
Unemployment * No Formal Qualifications		-0.062 (0.0461)		-0.0054** (0.0028)
Unemployment * Upper Secondary Vocational		-0.041** (0.0173)		-0.0038*** (0.0016)
Unemployment * Post-Secondary Non-Tertiary		-0.031 (0.0563)		-0.0120 (0.0084)
Unemployment * Tertiary Vocational		-0.055 (0.0409)		-0.0058 (0.0074)
Unemployment * Tertiary Academic		-0.0003 (0.0389)		-0.0023 (0.0031)
Individual & Time FE				
Demographics				
Employment Experience				
Job Characteristics				
N. of Obs.	27,477	27,477	27,477	27,477
R-squared	0.859	0.859	0.860	0.860

Note: Clustered standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table 6. Wage Penalty by Age

	(1) Unemployment Dummy	(2) Unemployment Duration
Unemployment (Baseline 25 – 35)	-0.017 (0.0187)	-0.0043*** (0.0016)
Unemployment * 36 – 45 (Difference)	-0.017 (0.0152)	0.0005 (0.0015)
Unemployment * 46 – 55 (Difference)	-0.046** (0.0203)	-0.0003 (0.0025)
Individual & Time FE	✓	✓
Demographic Characteristics	✓	✓
Employment Experience	✓	✓
Job Characteristics	✓	✓
N. of Obs.	27,477	27,477
R-squared	0.859	0.860

Note: Clustered standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Tables – Appendix

Table A1. Summary Statistics of the Sample for the Duration Analysis

	Mean	SD
Transition into Employment	0.74	0.44
Transition into Inactivity	0.07	0.26
Censored Spells	0.16	0.37
Months of Transition into Employment	7.37	10.47
Months of transition into Inactivity	15.46	21.02
No Formal Qualifications	0.14	0.35
Upper Secondary Vocational	0.61	0.49
Post-Secondary Non-Tertiary	0.07	0.25
Tertiary Vocational	0.05	0.23
Tertiary Academic	0.12	0.33
Age	39.05	8.76
Aged 25-35	0.39	0.49
Aged 36-45	0.33	0.47
Aged 46-55	0.28	0.45
East	0.38	0.49
Married	0.44	0.50
Young Children	0.16	0.37
Middle-Aged Children	0.17	0.37
Old Children	0.37	0.48
N. of Spells	3,449	

Note: Not weighted.

**Table A2. Months Spent in Unemployment before Exit into Employment,
by Educational Attainment**

	Age 25 – 35			Age 36 – 45			Age 46 – 55		
	P25	P50	P75	P25	P50	P75	P25	P50	P75
Upper Secondary Vocational	2	5	11	2	5	13	3	8	27
# of observations		834			707			631	
Academic Degree	2	5	10	3	9	13	4	8	20
# of observations		124			150			161	

Note: The table presents survival times at different percentiles of the duration distribution (denoted by P25, P50 and P75. Values are shown only for the other educational groups do not entail a sufficiently large number of spells.

Table A3. Competing Risk - Choice of Baseline Hazard

	(1)		(2)		(3)		(4)	
	Employment	Inactivity	Employment	Inactivity	Employment	Inactivity	Employment	Inactivity
Upper Secondary Vocational	0.589*** (0.106)	-0.440* (0.260)	0.587*** (0.106)	-0.437* (0.258)	0.585*** (0.106)	-0.426* (0.258)	0.587*** (0.106)	-0.422 (0.261)
Post-Secondary Non-Tertiary	0.649*** (0.164)	0.415 (0.445)	0.676*** (0.162)	0.422 (0.442)	0.668*** (0.162)	0.450 (0.442)	0.672*** (0.162)	0.467 (0.443)
Tertiary Vocational	0.724*** (0.177)	-0.020 (0.520)	0.711*** (0.176)	-0.050 (0.514)	0.706*** (0.176)	-0.032 (0.514)	0.708*** (0.176)	-0.005 (0.517)
Tertiary Academic	0.743*** (0.143)	0.477 (0.368)	0.730*** (0.142)	0.457 (0.364)	0.725*** (0.142)	0.478 (0.361)	0.724*** (0.142)	0.467 (0.365)
Age 36 – 45	-0.325*** (0.0841)	-0.329 (0.266)	-0.310*** (0.0837)	-0.301 (0.261)	-0.308*** (0.0837)	-0.306 (0.262)	-0.312*** (0.0839)	-0.303 (0.258)
Age 46 – 55	-0.766*** (0.0928)	-0.305 (0.270)	-0.715*** (0.0915)	-0.252 (0.263)	-0.713*** (0.0915)	-0.263 (0.263)	-0.718*** (0.0913)	-0.272 (0.259)
Baseline	Int		t+t2		t+t2+t3		Non-parametric	
Year Fixed Effects	✓		✓		✓		✓	
Demographics	✓		✓		✓		✓	
Job Characteristics	✓		✓		✓		✓	
N. of Spells	3,449		3,449		3,449		3,449	
AIC	63,903,667		63,321,198		63,306,399		62,899,699	
BIC	63,904,309		63,321,857		63,307,075		62,900,797	
NxT	34,526		34,526		34,526		34,526	

Note: Clustered standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table A4. Testing Differences between Wage Penalties of Different Educational Groups

	(1) Base: No Formal Qualifications	(2) Base: Upper Secondary Vocational	(3) Base: Post-Secondary Non-Tertiary	(4) Base: Tertiary Vocational	(5) Base: Tertiary Academic
Unemployment (Base)	-0.0054** (0.0028)	-0.0038** (0.0016)	-0.0120 (0.0084)	-0.0058 (0.0074)	0.0023 (0.0031)
Unemployment * No Formal Qualifications		-0.0017 (0.0032)	0.0066 (0.0089)	0.0004 (0.0078)	-0.0031 (0.0041)
Unemployment * Upper Secondary Vocational	0.0017 (0.0032)		0.0083 (0.0085)	-0.0021 (0.0075)	-0.0014 (0.00342)
Unemployment * Post-Secondary Non-Tertiary	-0.0066 (0.0089)	-0.0082 (0.0085)		-0.0062 (0.0111)	-0.0097 (0.0084)
Unemployment * Tertiary Vocational	-0.0004 (0.0078)	-0.0021 (0.0075)	0.0062 (0.0111)		-0.0035 (0.0079)
Unemployment * Tertiary Academic	0.0031 (0.0041)	-0.0014 (0.0034)	0.0097 (0.0084)	-0.0035 (0.0079)	
Individual & Time FE	✓	✓	✓	✓	✓
Demographics	✓	✓	✓	✓	✓
Employment Experience	✓	✓	✓	✓	✓
Job Characteristics	✓	✓	✓	✓	✓
N. of Obs.	27,477	27,477	27,477	27,477	27,477
R-squared	0.860	0.860	0.860	0.860	0.860

Note: Clustered standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table A5. Wage Penalties by Educational Group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Unemployment Dummy	Unemployment Dummy	Unemployment Dummy	Unemployment Dummy	Unemployment Duration	Unemployment Duration	Unemployment Duration	Unemployment Duration
Unemployment *No Formal Qualifications	-0.085* (0.0478)	-0.084* (0.0474)	-0.071 (0.0474)	-0.062 (0.0461)	-0.0058* (0.0032)	-0.0060** (0.0029)	-0.0053* (0.0028)	-0.0054* (0.0028)
Unemployment * Upper Secondary Vocational	-0.059*** (0.0186)	-0.054*** (0.0179)	-0.043** (0.0179)	-0.041** (0.0173)	-0.0054*** (0.0012)	-0.0048*** (0.0016)	-0.00383** (0.0017)	-0.0038** (0.0016)
Unemployment * Post- Secondary Non-Tertiary	-0.067 (0.0587)	-0.042 (0.0569)	-0.043 (0.0556)	-0.031 (0.0563)	-0.0197*** (0.0071)	-0.0134 (0.0085)	-0.0132* (0.0079)	-0.0120 (0.0084)
Unemployment * Tertiary Vocational	-0.062 (0.0412)	-0.081* (0.0416)	-0.069* (0.0410)	-0.055 (0.0409)	-0.0064 (0.0077)	-0.0078 (0.0079)	-0.0072 (0.0078)	-0.0058 (0.0074)
Unemployment * Tertiary Academic	-0.012 (0.0413)	-0.013 (0.0403)	-0.003 (0.0399)	-0.0003 (0.0389)	-0.0041 (0.0031)	-0.0039 (0.0030)	-0.0031 (0.0031)	-0.0023 (0.0031)
Individual & Time FE	✓	✓	✓	✓	✓	✓	✓	✓
Demographics		✓	✓	✓		✓	✓	✓
Employment Experience			✓	✓			✓	✓
Job Characteristics				✓				✓
N. of Obs.	27,477	27,477	27,477	27,477	27,477	27,477	27,477	27,477
R-squared	0.851	0.857	0.858	0.860	0.851	0.857	0.858	0.859

Note: Clustered standard errors in parentheses.

*** p<0.01, ** p<0.05, * p<0.1

Table A6. Average Education and Wages by Age Group

	Workers of age 25-35	Workers of age 36-45	Workers of age 46-55
	Mean(St. Dev.)	Mean(St. Dev.)	Mean(St. Dev.)
No Formal Qualifications	0.10	0.08	0.06
Upper Secondary Vocational	0.44	0.44	0.48
Post-Secondary Non-Tertiary	0.11	0.08	0.05
Tertiary Vocational	0.07	0.11	0.12
Tertiary Academic	0.28	0.29	0.29
Hourly Real Wage	14.44 (7.31)	17.99 (11.25)	17.26 (9.64)
N. of Obs.	9,860	10,551	7,066

Note: Observations pooled, one observation per worker per year, not weighted.