

Early Careers of Dropouts from Vocational Training: Signals, Human Capital Formation, and Training Firms

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Abstract

Dropping out of post-secondary education has negative consequences for career progression. However, as human capital theory predicts and as previous studies have shown, having some training still pays off. For a large part of the European workforce who has attended vocational training, however, the theoretical predictions are less clear and empirical studies are scarce. In occupational labour markets, signalling and credentialism theories predict negative effects of dropping out. Furthermore, apprenticeship dropouts learn at different training firms, which differ in their influence on human capital development and the provision of job opportunities. Relying on a unique panel data set from Germany and estimating normalized fixed effects growth curve estimators, our study reveals the following results. First, the timing of dropping out structures career progression, as late dropouts have the highest employment rates and highest wages within the dropout population. However, in an occupational labour market setting, credentials and signals are still highly important for career progression, as the wage advantage of late dropouts within the dropout population is rather small, and late dropouts suffer a wage penalty when we compare their wage profiles to those of graduates. Second, our study emphasizes the importance of training firms, which influence the human capital development of individuals during the course of training and provide dropouts with connections to their first jobs. Thus, in occupational labour markets, the consequences of dropping out depend mainly on different mechanisms, as in other settings.

Introduction

Dropping out of upper secondary education has long-lasting negative pecuniary and non-pecuniary consequences in modern labour markets (e.g. [Johnes and Taylor, 1991](#); [Bailey et al., 2004](#); [Campolieti et al., 2010](#); [Brekke, 2014](#); [Campbell, 2015](#); [Hällsten, 2017](#)).

Research also reveals that investments in human capital pay off as dropouts with more years of education attain higher wages and find jobs with higher prestige scores (e.g. [Kane and Rouse, 1995](#); [Grubb, 2002](#); [Bailey et al., 2004](#); [Matković and Kogan, 2012](#); [Reisel, 2013](#); [Schnepf, 2017](#)). To date, this research has not focused

on occupational labour market settings in which returns to education strongly depend on the attainment of formal degrees (e.g. Shavit and Müller, 1998; Bol and van de Werfhorst, 2011).

Therefore, for a large part of the European labour market, which, in countries such as Germany, Austria, Denmark, Slovakia or Switzerland, is characterized by apprenticeship training systems and occupational labour markets (Bol and van de Werfhorst, 2013), it remains unclear whether dropouts benefit from human capital investments. Furthermore, current research provides no evidence on how the labour market careers of dropouts evolve after the termination of education, as studies rely on outcomes measured at one point in time. Employing a longitudinal perspective is important because a dynamic view of labour market outcomes enables us to assess the long-term consequences of good or bad starting points in the school-to-work transition. In addition, no study directly addresses the differences in context moderators (i.e. the learning environment) that might influence the school-to-work transition and the subsequent career progression of dropouts. Considering the social context is important because the differences in context conditions can account for the differences in the human capital development of students (e.g. Lizzio, Wilson and Simons, 2002; Dietrich, Pfeifer and Wenzelmann, 2016).

To address the outlined research gap, our study investigates the early career progression of dropouts in Germany—a country with an occupationally stratified labour market with strong occupational credentialism (Solga and Konietzka, 1999; Bol and van de Werfhorst, 2011; Bol and Weeden, 2015). We investigate the growth of employment experience and wages within the first 10 years after the termination of education and focus on dropouts from apprenticeship training. Apprenticeship dropouts are an ideal population in which to test the importance of human capital formation and the attainment of formal degrees for career progression, as labour market outcomes in this institutional setting strongly depend on formal degrees (Bol and van de Werfhorst, 2011). This population is also well suited for answering our research question because many university dropouts receive pre- or post-tertiary vocational education (Scholten and Tieben, 2017), thereby complicating the assessment of the human capital value of university education. As apprenticeship dropouts will never receive any kind of additional post-secondary degree, analysing the career progression of this group facilitates testing the theoretical mechanisms under study.

Moreover, studying apprenticeship dropouts in Germany constitutes an interesting test case because the mode of learning under study is deemed to be one reason why Germany has such a low youth unemployment rate (e.g. Jacob and Solga, 2015). The ‘protective’ factor of the German dual apprenticeship system therefore interests many policy makers in different European countries (e.g. Portugal, Greece, Spain, Latvia, Slovakia, and Italy) who want to implement or enhance their apprenticeship systems (European Memorandum, 2012). In providing insights into the capability of apprenticeship training to endow even the least educated with valuable labour market skills, this study contributes to research and to the European policy agenda.

Furthermore, in scrutinizing the role of training firms in early career progression, this study sheds light on the demand side of the labour market. This is important, as research in labour market sociology still focuses mainly on the supply side (Bills, Di Stasio and Gërxhani, 2017). In analysing the moderating role of training firms in career progression, our study adds in part to a growing body of research that focuses on the demand side of the labour market (e.g. Di Stasio, 2014; Di Stasio and van de Werfhorst, 2016). In this vein, our study aims to identify the structural conditions at labour market entry that moderate the career progression of dropouts.

In addition, Germany provides a unique panel data set that combines register data from the Federal Employment Agency as well as the chamber of industry and commerce and the chamber of crafts data of the Federal State Saarland. These data contain detailed information on the timing of dropping out, the grades of graduates, and training firms. In addressing heterogeneity in length of training within the dropout population, we can assess whether adverse labour market outcomes of non-degree holders are the same for each dropout, as predicted by notions of signalling or credentialing theory, or whether they can be altered by human capital investments.

This unique panel data set also facilitates the estimation of the development of labour market outcomes. Our empirical approach employs a two-stage estimation approach. First, we assess differences in employment experience and wages in the school-to-work transition with linear regression models. Second, we assess the development of the employment experience and wages by fixed effects growth curve models that are normalized to the differences between dropouts and graduates in the first year after the school-to-work transition. A conditional assessment of career progression is important because research has shown that the entry

position in the labour market determines individuals' career prospects (e.g. Blossfeld, 1987; Scherer, 2004; Gangl, 2006).

Institutional Setting

In Germany's occupational labour market, apprenticeship training alongside university education is a major provider of post-secondary education. Within the apprenticeship training system, school leavers apply to job openings and firms select applicants based on their performance in school and their noncognitive skills (Protsch and Solga, 2015). School leavers can attain formal degrees in approximately 300 training occupations. Attaining these formal degrees, which are important signals of one's productivity and credentials (i.e. degrees facilitating access to closed occupations), is highly relevant for a smooth school-to-work transition and subsequent career progression (Müller and Gangl, 2003; Van de Werfhorst and Mijs, 2010; for a detailed overview of the German system, see, for example Raffé, 2014; Solga *et al.*, 2014).

Nevertheless, 24.6 per cent of apprentices prematurely cancel their training contracts with a training firm (Federal Institute of Vocational Education and Training, 2016: p. 181). This cancellation rate has been more or less stable since the late 1990s. The cancellation of training contracts depends on citizenship, educational level, sector (Federal Institute of Vocational Education and Training, 2016: p. 183) and the characteristics of training occupations (Rohrbach-Schmidt and Uhly, 2015). However, cancelling a training contract does not always lead to dropping out. According to the statistics of the Federal Institute of Vocational Education and Training (2016: p. 135), 7.6 per cent of all apprentices in one starting cohort (number based on the year 2014) had already prematurely cancelled an earlier training contract. Furthermore, the high number of individuals reconsidering their initial training decisions and not dropping out of the apprenticeship system stresses the importance of identifying 'real' dropouts (i.e. individuals who have stopped their investment in education).

The data of the Federal Institute for Vocational Education and Training also demonstrate that the majority of dissolved training contracts (approximately 65 per cent) have a maximum length of 1 year of training, 25 per cent of dissolved training contracts have a maximum of 2 years, and 10 per cent have a maximum of 3 years. These figures suggest a large amount of variation in the timing of premature cancellations. Consequently, our empirical analysis can explore this variation to test human capital expectations. However, the institutional setting used here,

which strongly emphasizes the importance of degree attainment, suggests that the theoretical mechanisms of signalling and credentialing are also highly important.

Human Capital, Signalling, Credentialing, and Training Context

Human Capital

Research directly addressing the labour market consequences of dropping out of apprenticeship training is scant. However, related research on early school leaving shows that premature termination of education is associated with low occupational attainment, less labour market attachment, non-standard employment, and low wages (Solga, 2005, 2008; De Vries and Wolbers, 2005; Gesthuizen and Scheepers, 2010; Giesecke *et al.*, 2015). Research addressing dropping out of university in the United States indicates that knowledge and skills acquired during education matter for the wages and earnings of dropouts (e.g. Kane and Rouse, 1995; Grubb, 2002; Bailey *et al.*, 2004; Reisel, 2013). Recent research on employment and the occupational status of dropouts from tertiary education in 15 European countries corroborates these findings (Schnepf, 2017). A study that explicitly explores the variation in the timing of student dropouts from universities in Croatia and Serbia finds that late dropouts fare well in external labour markets, as individuals dropping out late have access to more prestigious jobs compared to early dropouts (Matković and Kogan, 2012).

The findings on dropouts outlined above are thus in line with human capital theory (Becker, 1964), which assumes that the skills acquired in school expand individual human capital resources and contribute to productivity. However, it remains unclear whether human capital investments matter in occupational labour markets, as most of the presented findings were found for labour markets with a strong focus on on-the-job training.

Based on the findings of previous research and the basic assumptions of human capital theory, we formulate the following expectations. On the one hand, at the beginning of their careers, dropouts from apprenticeship training have, on average, worse starting points (i.e. less employment experience in the first year after termination of education and lower starting wages) than graduates, and they are not able to catch up to graduates during their early careers. On the other hand, when taking the timing of dropping out into account, human capital theory expects differences in labour market outcomes according to differences in years of schooling. Thus, late dropouts have a smoother school-to-work transition and

accumulate more employment experience and income during their early careers than do early dropouts. Moreover, based on the human capital approach, we expect that late dropouts develop similar careers to those of graduates, as they spend almost the same amount of time in training (*human capital expectations*).

The Role of Signals and Credentials

In contrast, with human capital expectations, competing predictions about the career progression of dropouts can be derived from signalling (Spence, 1973) and credentialing theory (Collins, 1979). According to the notion of signalling, educational degrees indicate individual productivity to potential employers. Therefore, matching (or the position in the labour queue) between potential employees and employers depends on the quality of the signals. As dropouts do not attain a valid market signal, they signal low productivity to potential employers.

In addition, credentialing theory assumes ‘that degrees function as a means of closure’ (Bol and van de Werfhorst, 2011: p. 121). Following this notion, credentials are not signals of productivity; rather, they are the necessary precondition to access certain occupations in the labour market (Weeden, 2002). Thus, without attaining a vocational degree, dropouts have limited employment opportunities compared with graduates and are more likely to work in secondary segments of the labour market (i.e. they have access to jobs that do not provide occupational careers). These limited opportunities due to credentialism are particularly pronounced in the German labour market, which is highly structured along occupations (Marsden, 1990) and in which educational credentialing is highly important for labour market outcomes (Bol and Weeden, 2015).

Based on the notions of signalling and credentialing theory, we formulate the following expectations: first, and in accordance with human capital expectations, at the beginning of their careers, dropouts from apprenticeship training have worse starting points than graduates. Second, and in contrast with human capital expectations, dropouts, regardless of the length of training, are not able to catch up to graduates during their early careers (*signalling and credentialing expectations*).

The Role of Training Firms

As mentioned before, dual apprenticeship training—the form of vocational training under study—is organized by vocational schools and training firms. Therefore, training firms play a major role in the transition from training into the labour market and might challenge the

expectations we have formulated so far. This subsection argues that training firms, as one relevant social context in the school-to-work transition, influence dropouts’ transitions into the labour market in two key ways. First, depending on their quality, training firms might modify the human capital endowment of dropouts differently. Second, training firms can provide dropouts with links to jobs.

Research on university students shows that a high-quality learning context (e.g. good teaching or appropriate workload) has a positive influence on the academic performance and skill development of students (Lizzio *et al.*, 2002). Research on apprentices in Germany shows that returns to training in high-quality training firms (i.e. in firms that invest heavily in the training of apprentices) are higher than the returns in low-quality training firms (Dietrich *et al.*, 2016). Thus, human capital formation within the firm-based training system depends on the quality of training firms. Potential mechanisms that boost human capital formation in high-quality training firms might be high-ability co-workers (peers and instructors) or high-quality infrastructure (i.e. training conditions) that supports the skill development of apprentices. Consequently, returns to education from high-quality training firms are higher compared to those from low-quality training firms.

In addition to their impact on human capital formation, training firms have a bridging function to the labour market. By hiring school leavers and training them, these firms prepare young individuals for the labour market. In doing so, training firms not only invest in the human capital of apprentices (see Mühlemann, 2016 for an overview on human capital development) but also screen the actual productivity of their potential future employees. Thus, screening might suspend the mechanism of occupational matching through credentials (Solga and Konietzka, 1999) because ‘... the allocation of labour power does not take place in accordance with formal educational qualifications, but rather in accordance with the experience that the employer has gained of employees’ (Blossfeld and Mayer, 1988: p. 138). If employers value the information gathered on their (potential) employees more than they value formal certificates, dropouts that terminate training at later stages might be particularly able to access the labour market, as employers have had sufficient time to screen their actual ability (or other relevant factors such as motivation or fit). Thus, dropouts can benefit from this particular institutional feature of the dual apprenticeship system and gain access to jobs even though in an occupational labour market, credentials are normally crucial for

labour market integration (Bol and van de Werfhorst, 2011).

The necessary preconditions for the assumed theoretical mechanism at play are that firms have job openings in general (i.e. internal labour markets) and that there is a job market for apprentices. Large firms, in particular, offer ties to internal labour markets (e.g. Blossfeld and Mayer, 1988; Hassink, 1996). A job market for apprentices is present when training firms have high retention rates (i.e. when they keep their apprentices after the training period as regular employees) (Von Wachter and Bender, 2006).

According to the arguments presented in this subsection, we expect that individuals from high-quality training firms have higher levels of human capital. In addition, large firms and firms that provide a job market, especially for apprentices, should influence the early career progression of dropouts and graduates. These features could be particularly beneficial for late dropouts, as this group spends a sufficient amount of time in training, allowing firms to both alter the human capital endowment and screen potential future employees. Therefore, we expect that late dropouts from high-quality training firms, large training firms and firms that provide an apprentice job market develop similar careers to those of graduates (*training-firm expectation*).

Empirical Design and Data

Analytic Strategy and Models

Methodologically, the main aim of this study is to estimate unbiased growth curves of employment experience and wages in the first 10 years after the termination of education. The best way to estimate unbiased growth curves uses a within estimator (Brüderl, 2015) because the fixed effects estimation has the major advantage that estimates are not affected by individual-specific time-constant unobserved factors (Allison, 2009). For our analysis, this feature is particularly beneficial because we employ German register data that contain no information on social background, personality traits or non-cognitive skills. The employed fixed effects models are as follows:

$$Y_{it} = \alpha_i + \beta_1 t_{it} + \beta_2 t_{it}^2 + \beta_3 D_i * t_{it} + \beta_4 D_i * t_{it}^2 + \gamma X_{it} + \delta \text{Unemp}_t + \varepsilon_{it}, \quad (\text{M1a})$$

$$Y_{it} = \alpha_i + \beta_1 t_{it} + \beta_2 t_{it}^2 + \beta_3 D_i * Q_i * t_{it} + \beta_4 D_i * Q_i * t_{it}^2 + \gamma X_{it} + \delta \text{Unemp}_t + \varepsilon_{it}. \quad (\text{M1b})$$

In each equation, Y_{it} represents either employment experience or the (average) logarithm of the daily wage in one calendar year. ε_i captures the idiosyncratic error

term and α_i the individual fixed effect to capture person-specific time-constant unobserved heterogeneity. t_{it} and t_{it}^2 represent years since termination of education. D_i represents the time-constant dropout indicator. The main interest in both equations lies in the coefficients β_3 and β_4 because they capture the heterogeneity in employment and wage growth between dropouts and graduates. X_i represents a vector comprising time-varying confounders available in the data, and Unemp_t contains the unemployment rate to capture the relevant macro indicator as a proxy for labour market conditions. In model M1b, we additionally add Q_i , representing the indicators of training-firm quality and job links.

The specified fixed effects growth curve model is the best way to describe the early career progression of dropouts because—as mentioned earlier—time-constant unobservables do not bias the growth trajectories. Furthermore, through demeaning the data and in the absence of group-specific attrition trends, selection out of our data set does not bias the estimated employment and wage profiles. However, when applying a fixed effects estimator, we are not able to compare outcomes across different groups over time. This inability is a major limitation because we are particularly interested in differences between different dropout and graduate groups. To overcome this major limitation, we normalize our fixed effects estimates to the differences in employment experience and wages between dropouts and graduates in the school-to-work transition (e.g. Frijters and Beaton, 2012). For the normalization, we first predict the differences between the dropout groups and graduate groups in the school-to-work transition based on observables. Second, we use these predictions to adjust the coefficients from the fixed effects growth curve model. In other words, we define a meaningful constant at labour market entry.

This procedure enables us to interpret level differences between groups. Empirical evidence and theoretical considerations justify the normalization to the differences in the school-to-work transition outcomes, as research unambiguously shows that entry positions in labour markets determine future career progression (e.g. Blossfeld, 1987; Scherer, 2004; Gangl, 2006). The normalization equations are ordinary least squares regressions and are specified as follows:

$$Y_i = \beta_0 + \beta_1 D_i + \beta_2 X_i + \varepsilon_i, \quad (\text{M2a})$$

$$Y_i = \beta_0 + \beta_1 D_i + \beta_2 X_i + \alpha_1 Q_i + \alpha_2 Q_i * D_i + \varepsilon_i. \quad (\text{M2b})$$

In both equations, Y_i represents employment experience in the first year after the termination of education

or the logarithm of the daily wage at the first employer. ϵ_i captures the idiosyncratic error term, and D_i represents the dropout indicator. The main interest in both equations lies in the coefficient β_1 , which captures heterogeneity in employment and wages between dropouts and graduates. X_i represents a vector comprising variables that confound the relationship between Y_i and D_i and capture selection into D_i . In model M2b, we also add Q_i to represent the indicators of training-firm quality and job links.

In the normalization models, we try as best as possible with our data to account for selection into dropping out and confounding bias (Elwert and Winship, 2014). Therefore, we control for socio-demographic factors (i.e. gender, citizenship, and level of secondary schooling) determining dropping out as well as the outcome measure. In addition, we introduce a dummy variable indicating retention by the training firm (i.e. whether a graduate or dropout works for at least 180 consecutive days after (premature) termination of education at the training firm) and another dummy indicating whether an individual has prior training experience (i.e. apprenticeship training spells).¹ The last indicator is important because we identified the final apprenticeship training of individuals (i.e. individuals are no longer investing in apprenticeship training). Focusing on the last training investment is important because we hypothesized that this social context is relevant for further career progression.²

Furthermore, we try to capture selection into dropping out by accounting for the employment biography of individuals prior to their last apprenticeship training. In doing so, we control for labour market experience before the last educational investment (i.e. prior unemployment, marginal employment, and full-time employment). As our data do not provide information on parental occupation or education, controlling for prior labour market experiences is important because this captures parts of the social origin effect. Furthermore, we control for part-time employment after training. Cohort effects are captured through dummy variables indicating the starting year of training.

Taking the presented selection variables into account is important for the estimation of group differences in the school-to-work transition. However, an approach solely relying on observables is still likely to deliver somewhat biased results. As our analysis focuses on the conditional assessment of the career progression of dropouts, selection into dropping out is a problem only if it affects our predicted trends differently for dropouts and graduates. Although we cannot rule out this possibility, our estimation strategy is still the best to describe

the wage and employment trajectories of dropouts and graduates.

To test the competing expectations formulated earlier, we create groups that are more or less comparable to each other. When presenting our results, we always rely on two contrasts. First, and within the dropout group, we compare late dropouts (i.e. individuals dropping out after 2 years of training) to medium (i.e. individuals who invested between 1 and 2 years of training) and early dropouts (i.e. individuals with a maximum of 1 year of training). With this contrast, we test whether skills learned during training can be transferred into the labour market. Second, we compare late dropouts to low-achieving graduates (i.e. graduates who almost failed their final examinations), which enables us to test whether the certificate achieved is crucial for successful labour market integration because we compare two groups with a similar ability endowment who spent similar amounts of time in training. To elaborate on the influence of training firms on career progression, we also rely on the second contrast.

While we try our best to create comparable groups, time-varying unobservables could still influence the likelihood of dropping out, thereby challenging the interpretation of our results. These time-varying unobserved characteristics, however, must systematically differ between and differently affect the growth trajectories of the contrasted groups (i.e. late vs. medium and early dropouts and late dropouts vs. low-achieving graduates). Other approaches, such as random effects regressions, make stronger assumptions. Based on the exogeneity assumption of the fixed effects approach, we are confident that we are able to test human capital against signalling and credentialist reasoning. However, selection into dropping out remains an issue and challenges causal interpretations of our results.

Data and Measures

To implement our empirical design, the analysis employs unique panel data. These unique data stem from a linked panel data set that combines information from the integrated employment biographies (IEB) of the Institute for Employment Research and information from the Saarland Chamber of Industry and Commerce and Chamber of Crafts. The data include all apprentices in companies in Saarland who were enrolled for at least 1 day between 1999 and 2002 (for more details see Wydra-Somaggio, 2015). Our sample of the IEB includes information on employment histories up to the year 2012.³

The employed data set has many advantages. First, the data allow a straightforward identification of dropouts because the chamber data include a cancellation indicator. Second, the administrative data provide a sufficient number of dropouts. Third, the data contain information about the grades of apprentices. This information is particularly important because we compare low-achieving graduates to late dropouts.⁴ Fourth, the register data encompass very good employment and wage measures as they stem from firm dispatches. Fifth, the data encompass training-firm characteristics that are often a black box in survey-based research. Sixth, the data include every student who started an apprenticeship. Therefore, we rely on a full sample and survey selection is not a concern in our study. Seventh, the data are organized as spell data. Thus, they comprise the entire (un-)employment biographies of socially dependent workers and registered unemployed and enable us to construct a longitudinal data set (for more information, see [Oberschachtsiek et al., 2009](#)).

Within these data, we identify dropouts as individuals who begin an apprenticeship but do not obtain a formal vocational certificate. Graduates, by contrast, do obtain a formal vocational certificate. Moreover, the data allow identification of the exact length of the apprenticeship training, which is relevant for our grouping. We divide dropouts into three groups: early (i.e. max. of 1 year of training), medium (i.e. between 1 and 2 years of training), and late dropouts (i.e. more than 2 years of training).

To assess the growth of employment experience and log daily wages over time, we employ a linear and quadratic time term. These measures simply indicate the years after the termination of education.

The measures used to investigate differences in the school-to-work transition and the development of early labour market careers are the monthly employment experience in one calendar year and the logarithm of the average daily wage in 1 year. Our employment variable captures only dependent employment, as our analysis relies on the social security reports of firms. The indicator we use is a count variable that cumulates months in dependent employment in 1 year. For the school-to-work transition analyses, we measure the employment experience in the first full year after termination of the final educational investment. In the panel analysis, we measure monthly employment experience in each subsequent year after the final investment in post-secondary education.

In addition to employment experience, we analyse daily wages. In the school-to-work analysis, we investigate differences in log daily wages at the first employer

after the termination of apprenticeship trainings. For the growth analysis, we rely on the logarithm of the average daily wage in one calendar year. Although wage information stems from a high-quality data source, we follow [Caliendo et al. \(2017\)](#) and apply top (highest percentile) and bottom (lowest percentile) recoding to reduce measurement error.

We operationalize two training-firm characteristics according to our theoretical considerations.⁵ First, we approximate the quality of training. An appropriate measure of training quality constitutes the experience a training firm has in providing apprenticeship training. The central assumption is that experienced firms have developed structured programmes over time or have at least one instructor with plenty of training experience who positively influences the human capital development of individuals. In our sample, the median firm has provided 18 years of apprenticeship training. For the empirical analysis, we build a dummy variable indicating whether a firm has more than 18 years of training experience.

Second, we approximate job opportunities. We use two indicators: the establishment size and the 3-year average retention rate. Research has shown that large firms offer ties to internal labour markets (e.g. [Blossfeld and Mayer, 1988](#); [Hassink, 1996](#)). We consider a training firm with more than 250 employees to be large organizations and build a dummy variable for the empirical analysis. In addition, we use a 3-year average retention rate to approximate job opportunities. This information is calculated on the establishment level. The 3-year period is conditioned for each individual on the starting year of the apprenticeship training. We argue that this measure approximates job opportunities because firms with high retention rates use apprenticeship training for future personnel planning. Thus, apprentices in firms with high retention rates are hired to fill future vacancies within the firm.

[Table 1](#) provides an overview of the distribution of the firm indicators and the general education level in the sample (right column). Furthermore, the table provides an overview of the distributions for low-achieving graduates and late dropouts, as this comparison will be important when we present the results. The table shows that differences in firm characteristics and educational background between low-achieving graduates and late dropouts are small. The presented distributions are an indication that low-achieving graduates and late dropouts are comparable groups that facilitate testing the proposed hypotheses, as both groups differ more or less in only one characteristic (i.e. not holding a certificate).

Table 1. Distribution of firm characteristics and educational levels in the sample and by subgroups

	Low achievers	Late dropouts	Sample
Firm indicators			
Firm with high training experience	41.38	43.70	46.32
Large training establishment	7.08	8.44	26.26
High average retention rate	26.19	23.84	24.78
Educational background			
Low	77.20	79.25	44.41
Medium	15.99	17.35	31.67
High	6.81	3.40	23.92
N individuals	807	559	14,094

Notes: The results from the χ^2 tests revealed that differences in firm characteristics between low-achieving graduates and late dropouts are not statistically significant.

Source: Ausbildungspanel Saarland.

As outlined in the section above, we apply normalized fixed effects growth curve models. Therefore, we normalize the growth curves' estimates to differences in the school-to-work transition. To estimate these differences as precisely as possible, we constructed two samples. First, we use a cross-sectional sample to estimate school-to-work transition outcomes. Second, we use a panel sample to estimate employment and wage profiles. In the cross-sectional file, we assess wages at the first employer and the employment experience in the entire first calendar year after the termination of education. Assessing the differences in employment experience in the first full year is important because dropouts and graduates terminate education at different points in time. Therefore, not harmonizing the observation period could artificially bias the results. The measurement of the panel outcomes starts on the first of January of the consecutive year.

The transition sample contains 14,094 individuals for the employment experience analysis and 10,831 individuals for the wage analysis. The panel sample comprises 104,004 person-years for the employment experience analysis and 73,980 person-years for the wage analysis. The period covered ranges from 2000 to 2012 (distribution of model variables of the first sample: Tables A1 and A2).

Results

Timing of Dropping out and Grades

Figure 1 shows the employment and wage growth of dropouts and graduates from apprenticeship training (full regression results of school-to-work analysis and panel analysis in Supplementary Tables B1 and B4). The black lines show trajectories of graduates, and the grey

lines show trajectories of dropouts. The left part of Figure 1 shows the average career progression of dropouts and graduates. The right part of Figure 1 shows the career progression of dropouts by the timing of termination of education and the progression of graduates by achievement. The upper part of Figure 1 shows employment growth, and the lower part of Figure 1 shows wage growth.

When analysing the average career progression of dropouts and graduates, we expect—based on the notions of human capital, signalling, and credentialing—that dropouts have poor starting points in the labour market and are not able to catch up to graduates. The left part of Figure 1 corroborates this expectation. In the first year after the school-to-work transition, dropouts accumulate 3 months less employment experience than graduates and are not able to catch up to graduates within the first 10 years after the termination of education (upper left part of Figure 1). In addition, the differences in starting wages remain stable throughout the first 10 years in the labour market (lower left part of Figure 1). Graduates have, on average, approximately 12 per cent higher daily wages.

When taking the timing of dropping out into account and comparing different dropout groups with each other, the findings of Figure 1 exhibit the structuring function of the training investments for the early career progression of dropouts. In accordance with human capital expectations, late dropouts accumulate more employment experience in the first year after the termination of education compared to early and medium dropouts (upper right part of Figure 1). The difference in labour market entry between late and early dropouts is approximately 2 months, and the difference between late and medium dropouts is approximately 1 month.

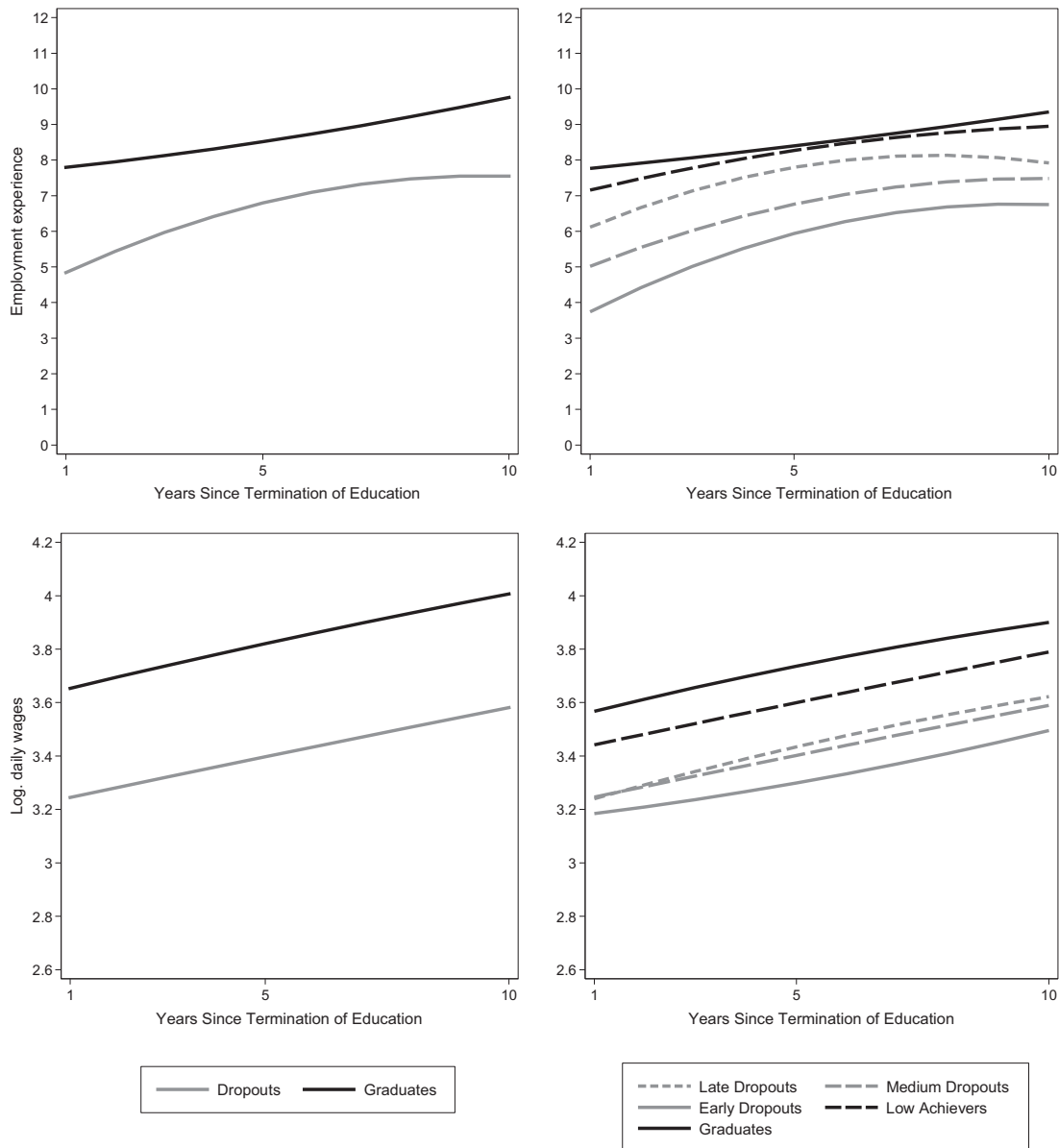


Figure 1. Conditional profile plots estimated by a normalized fixed effects growth curve model of timing of dropping out and graduates' achievement on labour market experience and log daily wages. *Dependent variables:* experience of full- or part-time employment and log yearly average of daily wages. *Controls for panel analysis:* citizenship, part-time, and unemployment rate. *Controls in school-to-work analysis:* level of schooling, graduation year, first year of training, and a set of dummy variables indicating male gender, German nationality, retention by training firm, second training, part-time, not employed before training, minor employment before training, full-time employment before training, and prior work experience at training firm. Employment experience analysis: N persons = 14,094; N person-years = 104,004. Wage analysis: N persons = 10,831; N person-years = 73,980

Source: Ausbildungspanel Saarland.

These differences remain fairly stable in the first 5 years after the premature termination of education. Afterwards, the employment profiles of late dropouts, medium dropouts, and early dropouts start to converge as the employment growth of late dropouts starts to stagnate earlier. In addition, the lower right part of [Figure 1](#) shows that the timing of dropping out structures the wage development of dropouts. Within the dropout population, late dropouts have steeper wage growth compared with medium and early dropouts. Therefore, the profiles diverge.

When taking the timing of dropping out into account and comparing late dropouts to low-achieving graduates, [Figure 1](#) shows only a small difference between employment profiles of late dropouts and low-achieving graduates (i.e. approximately 1 month). However, late dropouts are not able to catch up to low-achieving graduates in the first 10 years in the labour market. In addition, while late dropouts have the same wage growth as low-achieving graduates, they receive a clear wage penalty of on average 6.2 per cent and are not able to catch up to low-achieving graduates. Thus, the findings based on the comparison of late dropouts and low-achieving graduates indicate that vocational certificates are highly important for career progression.

In sum, the findings presented so far support predictions of human capital, signalling, and credentialing theory. However, the explanatory power of human capital theory appears to be limited. According to this theory, we expected that late dropouts have a smoother school-to-work transition and accumulate more employment experience and income during their early careers than do early and medium dropouts. Consequently, we should have found clear differences between the wage profiles of late and medium dropouts. The lower right part of [Figure 1](#) does not show such differences. In addition, the finding of convergence of the employment profiles of late, medium, and early dropouts also challenges the human capital explanation (see upper right part of [Figure 1](#)).

Furthermore, according to human capital theory, we expected that late dropouts develop similar careers to those of graduates, as they spend almost the same amount of time in training. Particularly, the findings on wage growth presented in the lower right part of [Figure 1](#) do not support this expectation as late dropouts receive a clear wage penalty in the early career. Thus, the findings presented in this subsection suggest that signalling and credentialing theory have more explanatory power compared with expectations based on human capital theory.

The Influence of Training Firms

The importance of training firms for employment growth

[Figure 2](#) shows the employment growth of late dropouts and low-achieving graduates from apprenticeship training and how training-firm characteristics influence the growth trajectories in the first 10 years after terminating education (full regression results of school-to-work analyses and panel analyses in Supplementary Tables B2 and B5).

[Figure 2b](#) indicates that dropping out late from high-quality training firms is associated with stable employment growth, as the employment profiles of late dropouts from high-quality training firms converge with those of low-achieving graduates. In contrast, the employment growth of late dropouts from firms with low training experience stagnates after 6 years in the labour market. This finding might be interpreted as evidence for the importance of firms in human capital development, as even dropouts without a formal degree benefit from high-level establishment training.

[Figure 2c](#) indicates that late dropouts do not profit from training at large establishments, as the employment profiles of late dropouts start to diverge from those of low-achieving graduates from large establishments after 4 years in the labour market. Surprisingly, late dropouts from small establishments develop similar employment careers to those of low-achieving graduates. Thus, our expectation that large firms provide links to internal labour markets cannot be confirmed.

[Figure 2d](#) indicates that dropping out late from establishments that provide an apprentice job market is associated with stable career development as the employment of this group grows over the entire observation period. Therefore, this finding might indicate that firms with apprentice job markets provide dropouts with links to jobs that ensure a stable employment career. However, our training-firm expectation is only partly confirmed. Originally, we hypothesized that late dropouts from establishments with an apprentice job market gain access to job openings in training firms at labour market entry. If so, the intercept of the employment profile of this group should have been close to the intercept of graduates, but the data do not show such a similarity. A potential driver of this finding found in [Figure 2d](#) might be selection on growth ([Ludwig and Brüderl, 2018](#)), i.e. a positively selected group of late dropouts—a group with access to permanent jobs—that was retained by their training firm might cause this pattern.

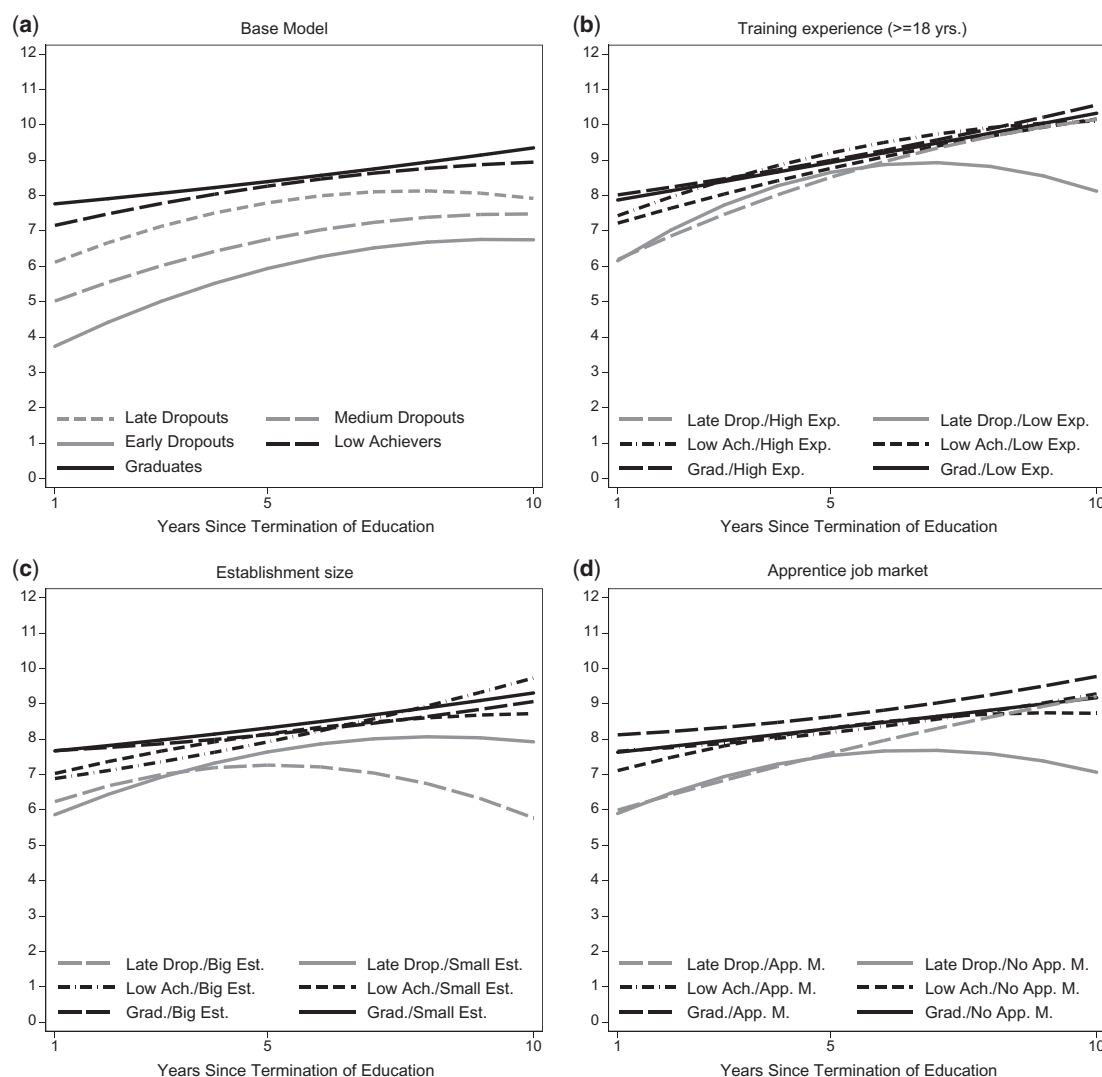


Figure 2. Conditional profile plots (a to d) estimated by normalized fixed effects growth curve models of dropping out and training-firm indicators on labour market experience. *Dependent variable:* experience of full- or part-time employment. *Controls for panel analysis:* citizenship, part-time, and unemployment rate. *Controls in school-to-work analysis:* level of schooling, graduation year, first year of training, and a set of dummy variables indicating male gender, German nationality, retention by training firm, second training, part-time, not employed before training, minor employment before training, full-time employment before training, and prior work experience at training firm. *N* persons = 14,094; *N* person-years = 104,004

Source: Ausbildungspanel Saarland.

The importance of training firms for wage growth

Figure 3 shows the wage growth of late dropouts and low-achieving graduates from apprenticeship training and how training-firm characteristics influence the growth trajectories in the first 10 years after terminating education (full regression results of school-to-work analyses and panel analyses in Supplementary Tables B3 and B6).

Figure 3 reveals that the wage growth of dropouts is hardly affected by training firms, as we find only very

small differences within the dropout population. However, differences within the graduate groups emerge. Poor training-firm characteristics seem to be associated with flatter wage growth for low-achieving graduates. Therefore, late dropouts from small firms almost catch up to low-achieving graduates from large firms (Figure 3c). A similar pattern—yet not so pronounced—occurs in Figure 3d: the wage profiles of late dropouts from firms with apprentice job markets

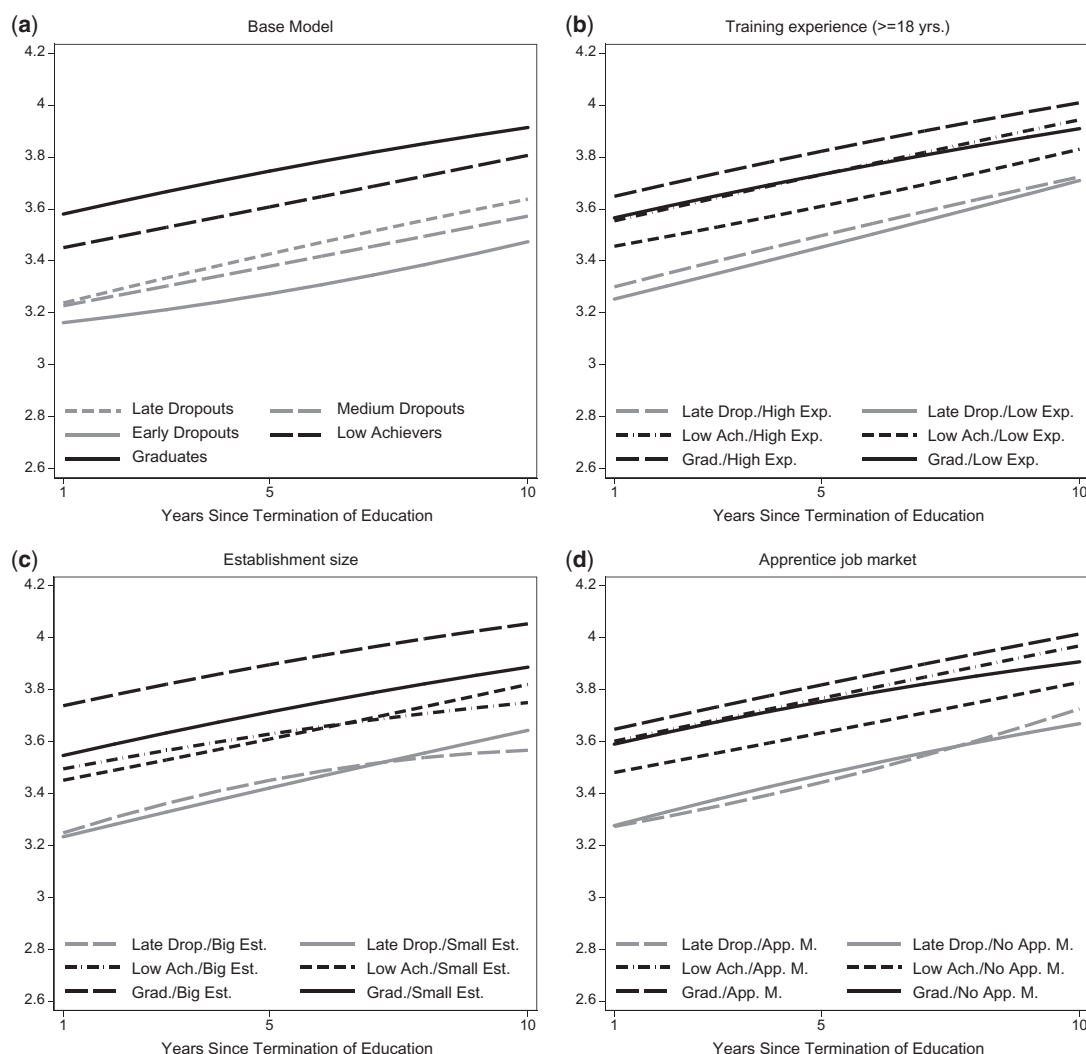


Figure 3. Conditional profile plots (a to d) estimated by normalized fixed effects growth curve models of dropping out and training-firm indicators on log daily wages. *Dependent variable:* log yearly average of daily wages. *Controls for panel analysis:* citizenship, part-time, and unemployment rate. *Controls in school-to-work analysis:* level of schooling, graduation year, first year of training, and a set of dummy variables indicating male gender, German nationality, retention by training firm, second training, part-time, not employed before training, minor employment before training, full-time employment before training, and prior work experience at training firm. *N* persons = 10,831; *N* person-years = 73,980

Source: Ausbildungspanel Saarland.

converge towards the profiles of low-achieving graduates from establishments without job markets. However, overall credentials rather than firm characteristics appear to be most important for wage development.

Discussion of findings on training firms

The results on training firms have repercussions for the interpretation of the findings presented earlier. We

showed that the late dropout group is not a homogeneous one as different training contexts are differently associated with career progression. The results on training firms are therefore useful for understanding the convergence pattern between experience profiles of late and medium dropouts presented in Figure 1. We showed that late dropouts from high-quality firms, small firms, and firms with an apprentice job market develop employment profiles similar to those of low-achieving

graduates. Therefore, the group of late dropouts that was not trained in these training environments drives the convergence patterns presented in [Figure 1](#) (upper right part of [Figure 1](#) in Timing of dropping out and grades section).

Moreover, one particular finding regarding the influence of training firms on career progression needs further discussion. In [Figure 2c](#), we show that late dropouts from small firms—instead of individuals from large firms—develop stable careers. A potential mechanism driving this result might be that if employers can choose between degree holders and dropouts, they favour degree holders. However, if employers cannot choose among different individuals because they have trained only one person—which is often true in small firms—they do provide dropouts with employment opportunities. We conducted complementary analyses and split the sample into firms with more than one or just one apprentice. The results reveal that late dropouts from large establishments without competition have employment opportunities similar to those of low-achieving graduates (these results are available upon request). Note, however, that larger firms on average are more likely to train more than one apprentice ([Mühlemann, 2016](#)).

Furthermore, the results presented in [Figure 2c](#) also show that the profiles of late dropouts from large and small firms are very similar in the first 4 years after termination of education. Thus, a further explanation might be warranted. Large establishments provide both internal and external labour markets with a core and peripheral workforce ([Doeringer and Piore, 1971](#)). As, *ceteris paribus*, access to internal labour markets depends on formal degrees, dropouts are more likely to enter external labour market segments within firms. These segments usually do not provide individuals with links to permanent jobs. Therefore, dropouts in larger firms have a higher probability of dismissal compared to graduates and dropouts from small firms. After dropping out from large firms, dropouts once again face competition in the general labour market and might therefore be trapped in external labour market segments throughout their careers ([Scherer, 2004](#)). Entrapment is likely because dropouts signal low productivity to future potential employers. Additionally, dropping out from a large establishment itself could add an additional negative signal, as, *ceteris paribus*, larger establishments provide more support to their apprentices over the course of training ([Mühlemann, 2016](#)).

Conclusion and Discussion

In our study of the early career progression of apprenticeship training dropouts, we set out to investigate whether dropouts can establish themselves in an occupational labour market. In this institutional setting, signalling and credentialing theory expect that individuals without the minimum standard of education, i.e. individuals without vocational certificates gained in the vocational system, do not find access to permanent jobs and therefore do not accumulate much employment experience and wages in their early career. However, dropouts are a heterogeneous group because the length of the training investments and learning environment vary substantially within the dropout group. Thus, human capital theory expects that certain dropout groups can develop similar early career patterns to those of graduates from apprenticeship training. In addition, high-quality training firms and firms that provide links to labour market entrance positions should influence the human capital formation of dropouts and provide certain dropouts with access to the labour market. Therefore, we expected that late dropouts from high-quality training firms, large firms, and firms with apprentice job markets would develop careers similar to those of low-achieving graduates from apprenticeship training.

Our results suggest that on average, dropouts have lower levels of experience and wage growth. Moreover, the results suggest that the timing of dropping out structures the level of employment and wage growth within the dropout population. These findings indicate that human capital investments in an occupational labour market might pay off. However, the employment growth of late dropouts stagnates after 7 years in the labour market, and the wage differences between late and medium dropouts are very small. These findings challenge the notion that the duration in human capital investments in an occupational labour market pays off. In addition, although late dropouts have the highest wages in their early careers within the dropout population, they suffer from a wage penalty compared with low-achieving graduates. Late dropouts have, on average, approximately 6.2 per cent lower daily wages than low-achieving graduates, implying that returns to signals and credentials in the occupationally structured labour market are still higher than human capital investments.

Our results further showed that firm characteristics influence early career outcomes. Late dropouts from

high-quality training firms, small firms, and firms with an apprentice job market develop stable employment careers. Moreover, the wage profiles of late dropouts from small training firms and training firms with an apprentice job market converge to the profiles of low-achieving graduates from large training firms and from training firms with no apprentice job market in the first 10 years in the labour market. Thus, late dropouts appear to benefit from good starting points at labour market entry. Overall, our results reveal the importance of training firms in individuals' school-to-work transition and their subsequent careers in occupational labour markets, as the theoretical mechanism of signalling and credentialing appears to be offset for a substantial subgroup in the labour market.

Our results also have policy implications. They show that the prevention of early dropout might be beneficial because this particular group is largely excluded from occupational labour markets. Preventing early dropout implies concentrating political effort on increasing the quality of matches between school leavers and training firms. Furthermore, against the background of declining firm engagement in the dual apprenticeship system, policy makers should strengthen their efforts to increase the number of training firms, as training firms have a connecting function in the labour market. This link function can be particularly valuable for low-skilled students. However, our results also stress that the quality of training and the presence of job opportunities within firms are highly important. Therefore, if European policy makers want to implement apprenticeship training systems (European Memorandum, 2012), they must include firms (i.e. potential future employers of apprentices) in this process.

One caveat underlying our analysis is that we cannot rule out unobserved factors that cause individuals to drop out. It is well known in the literature that individuals with emotional or health problems (McLeod and Kaiser, 2004; Haas, 2006) prematurely terminate investments in education. With our data, we cannot control for such factors. However, our main interest was the conditional assessment of the early career progression of dropouts. Moreover, the fixed effects estimates could be potentially biased, as they are still prone to time-changing unobservable factors, such as changing family context, changing health conditions or other context effects. Unfortunately, we cannot observe such factors in our data.

To learn more about dropout effects on careers, we need more combined data sets such as the 'Ausbildungspanel Saarland'. In particular, we need data sets combining surveys and register data. These

data sets would enable researchers to jointly assess individuals' reasons for dropping out and their subsequent labour market careers. Moreover, such data sets could enhance the measurement of contextual features such as the quality of training firms (e.g. with detailed information on instructors or co-workers). In addition, future research must go beyond identifying moderating factors amplifying or mitigating the dropout effect and examine mechanisms explaining differences between individuals over time.

Notes

- 1 Unfortunately, our data capture only apprenticeship training. Information on school-based training is therefore not available.
- 2 Conditioning on the last apprenticeship training is a rational decision because we can assume that those training conditions are relevant for the subsequent labour market entry and thus for one's subsequent career. With this condition, the empirical analysis accounts for individuals who have attained apprenticeship training prior to the final investment. The starting point of the last apprenticeship is the first day of the last apprenticeship episode in our data set. Therefore, we consider all individuals beginning their last apprenticeship in the Federal State Saarland between 1999 and 2002.
- 3 As the Saarland has undergone profound economic change over the last decades, its economic structure converged with that of West Germany (Trippel and Otto, 2009). The structure of the apprentice-occupations in Saarland corresponds to that of other states in West Germany and is in this respect representative. Our data do not allow comparisons to East Germany because of the huge differences between the educational systems of the 'Old' and 'New' federal states.
- 4 Unfortunately, the chamber data lack substantial information on grades, as the transmission of grades to the IAB was mandatory only for the graduation cohorts between 1999 and 2002. To account for missing data, we created a missing category in our group indicator; otherwise, we would lose too many observations in our estimations. All regression models include individuals with missing values in the grade indicator.
- 5 Every presented 'firm' indicator is created on the establishment level. The establishment level is the appropriate context level for our analysis, as the characteristics of establishment rather than those of an entire cooperative directly influence human

capital development and job opportunities. Note, however, that 75 per cent of enterprises consist of one establishment in our data. Therefore, we use the terms firm and establishment interchangeably.

Supplementary Data

Supplementary data are available at ESR online.

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Appendix A: Distribution of Model Variables

Sample 1

Table A1. Transition samples

	Experience sample		Wage sample	
	Mean	S.D.	Mean	S.D.
Experience (in months)/log daily wage	7.216	5.105	3.598	0.815
Dropouts	0.196	—	0.147	—
Graduate groups and dropout timing				
Graduates	0.352	—	0.370	—
Low-achieving graduates	0.057	—	0.059	—
No GPA* information	0.402	—	0.431	—
Early timing of dropout	0.089	—	0.059	—
Medium timing of dropout	0.060	—	0.049	—
Late timing of dropout	0.040	—	0.032	—
Large training firm	0.263	—	0.289	—
Firm with more than 18 years of training experience	0.463	—	0.489	—
Firm with an apprentice job market	0.248	—	0.259	—
Male	0.605	—	0.613	—
German	0.961	—	0.962	—
Level of secondary education				
Low	0.444	—	0.413	—
Medium	0.317	—	0.329	—
High	0.239	—	0.258	—
Prior training experience	0.177	—	0.166	—
Part-time	0.145	—	0.117	—
Not employed directly before last apprenticeship	0.066	—	0.056	—
Marginally employed directly before last apprenticeship	0.219	—	0.217	—
Full- or part-time employment directly before last apprenticeship	0.289	—	0.308	—
Prior employment at training firm	0.175	—	0.153	—
Retention at training firm	0.454	—	0.526	—
First year of training				
1999	0.263	—	0.271	—
2000	0.277	—	0.280	—
2001	0.267	—	0.265	—
2002	0.193	—	0.184	—
N persons	14,094		10,831	

In all following tables GPA stands for Grade Point Average.

Table A2. Panel samples

	Experience sample		Wage sample	
	Mean	S.D.	Mean	S.D.
Experience (in months)/log daily wage	9.084	4.575	4.224	0.416
Dropouts	0.201	0.401	0.138	0.345
Graduate groups and dropout timing				
Graduates	0.365	—	0.390	—
Low-achieving graduates	0.061	—	0.061	—
No GPA information	0.382	—	0.419	—
Early timing of dropout	0.092	—	0.053	—
Medium timing of dropout	0.062	—	0.047	—
Late timing of dropout	0.038	—	0.030	—
Time since termination of education				
Linear term	4.054	2.720	4.006	2.688
Quadratic term	23.833	24.603	23.278	24.039
Large training firm	0.266	—	0.298	—
Firm with more than 18 years of training experience	0.434	—	0.481	—
Firm with an apprentice job market	0.252	—	0.265	—
Part-time	0.285	—	0.260	—
German	0.962	—	0.963	—
Unemployment rate (in per cent)	8.811	1.614	8.785	1.610
N person-years	104,004		73,980	
N persons	14,094		10,831	