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The impact of changing youth employment patterns on future wages

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Abstract

This study examines employment patterns on the labor market for German apprenticeship graduates and returns to early-career employment stability over the past four decades. The data indicate the decreasing stability of youth employment since the late 1980s. Exploiting variation in the timing of macroeconomic shocks, I identify true state dependencies and find that stable employment early in professional life exhibits significant wage returns in future periods. These returns are particularly pronounced at the bottom of the wage distribution and have substantially increased during the 1990s. Accordingly, securing the training-to-work transitions would primarily be beneficial for the wage growth of workers with a generally low earning potential.

Zusammenfassung

Ich untersuche die Beschäftigungsverläufe von deutschen Ausbildungsabsolventen, wie sich frühe Beschäftigungsstabilität auf spätere Löhne auswirkt, und wie sich dieser Zusammenhang seit den späten 1970er Jahren verändert hat. In den Daten zeigt sich seit den späten 1980er Jahren ein Rückgang der Stabilität von Beschäftigung innerhalb der frühen Erwerbsphase. Indem ich zeitliche Abweichungen im Wirken von makroökonomischen Schocks zur Identifikation von wahrer Zustandsabhängigkeit nutze, finde ich, dass stabile Beschäftigung in einer frühen Phase des Erwerbslebens signifikant positive Lohneffekte nach sich zieht. Diese Renditen sind besonders im unteren Bereich der Verteilung zukünftiger Löhne ausgeprägt, und haben während den 1990er Jahren inbesondere in diesem Bereich merklich zugenommen. Demzufolge würde eine Absicherung des Übergangs von Ausbildung in den Arbeitsmarkt das spätere Lohnwachstum insbesondere von Personen mit einem geringen Lohnpotential fördern.

JEL classification: C20; J21; J31

Keywords: Youth employment; employment stability; returns to experience; true state dependence; quantile regression

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1 Introduction

In light of the alarming employment situation for young workers in many industrialized economies, there has been a renewed interest in the labor market conditions for young people. In April 2013, the Council of the European Union recommended the establishment of a Youth Guarantee to "ensure that all young people under the age of 25 years receive a good-quality offer of employment [...] within a period of four months of becoming unemployed or leaving formal education" European Union (2013: p. 3).

But does stable employment early in professional life provide long-term benefits at all? And how does the process of early-career progression respond to the challenges posed by the modern labor market? Evidence regarding these questions is still surprisingly limited. A deeper understanding of changing youth employment patterns and their role in wage determination, however, is important to efficiently promote the formation of long-lasting and productive employer-employee matches.

I contribute to this discussion by documenting that employment during the crucial early stage on the labor market has become less stable for a random sample of German males who graduated from the dual education system in West Germany between 1977 and 2001.

Furthermore, I investigate whether stable employment during the first years in the labor market actually leads to higher wages in future periods. This question is not straightforward since the role of early employment stability regarding future career progression is unclear: On the one hand, there is pronounced job mobility during the early years of a career, which is often interpreted as an expression of job searching resulting in exponential wage growth [cf. Bartel and Borjas (1981), or Topel and Ward (1992)]. Particularly young workers might thus be able to overcome disadvantageous conditions by means of rapid adjustment. On the other hand, stable employment patterns during the early career are often considered to play an important role, for example when firms screen job applicants by means of their employment history [cf. Vishwanath (1989), Gibbons and Katz (1991), Blanchard and Diamond (1994), or Atkinson (1996)], or if skills depreciate during periods of unemployment [cf. Pissarides (1992), or Acemoglu (1995)]. Consequently, it is an empirical question whether employment stability experienced early in professional life exhibits persistent wage returns.[1]

Recent developments such as skill-biased technological change, as documented by Autor, Levy and Murnane (2003) and others, or rising labor market intermediation, cf. e.g. Autor (2009), provide good reasons for conjecture that ongoing changes in the economic environment have altered the extent of state dependence between early labor market experiences and adult labor market outcomes. To comprehend whether the returns to early-career employment stability have changed over time, I finally conduct a decomposition analysis

[1] Such a structural link between past experiences and future outcomes is called *true state dependence* by Heckman and Borjas (1980). Unobserved factors, which are correlated with both youth employment and adult wages, like individual ability and motivation, might constitute a different source of correlation between these variables. The main goal here is to separate state dependence from all types of spurious correlations. Although the patterns revealed throughout the analysis provide some indication, explicitly unraveling the particular channels through which wage returns are ultimately generated is beyond the scope of this article.

in which I contrast the wage returns of graduates from different graduation periods while accounting for cohort effects, observed heterogeneity, and unobserved heterogeneity.

Exploiting macroeconomic shocks affecting otherwise identical workers at different points in their early career, I find significant returns to early-career employment stability: In terms of wages after 8 years of potential experience, the average rate of return to one additional year of full-time employment between the second and the fifth year in the labor market is in the preferred specification estimated as roughly 10 percent for graduates from the late 1980s. For graduates from the late 1990s the corresponding estimate is almost 16 percent. In the mean, the return to stable employment in youth is therefore not only economically important but has also markedly increased during the 1990s.

Additional to the baseline regressions in means, I apply quantile regressions. Pioneered by Koenker and Bassett (1978) this method allows estimating the returns at different points of the wage distribution, while mean regression assumes the return to be constant across the outcome variable's distribution. This type of effect heterogeneity reveals that the return to early-career employment stability varies considerably: while returns are substantial at the bottom, they decrease convexly over the wage distribution. In the long run over the career cycle within cohorts, however, positive returns appear to persist only in the lower quarter of the wage distribution. What is more, I also find some suggestive evidence that the returns to further educational achievement during the early career tend to exceed the returns to employment stability in the long run, especially in the upper tail of the wage distribution.

Analyzing the youth labor market requires rich and reliable data on both the individual and the establishment level. Administrative matched employer-employee data that contain a random sample of the universe of social security records in Germany – the Sample of Integrated Labor Market Biographies (SIAB) matched with the Establishment History Panel (BHP) – accomplish this task. From this data, I extract the sub-sample of German males who graduated from the dual education system in West Germany between 1977 and 2001. This system is well known for combining apprenticeships in a company and vocational education at a school. Most young people enter after completing grades nine or ten of lower secondary schooling. Apprentices are trained in one of about 300 different occupations, and the training usually takes two to three years depending on the occupation. On the one hand, the group of apprentices is quite homogenous in regard to former labor market experience, professional background and future expectations. On the other hand, apprenticeship graduates are not only a qualitatively but also a quantitatively important part of the German labor market (accounting for about 60 percent of the German workforce). Furthermore, because apprentices have to pay contributions to social security, detailed information on periods in the dual education system is recorded in the administrative data. Since graduating from the system also defines a clear point of labor market entry, potential problems caused by unobserved initial conditions can mostly be avoided. But even more importantly, the institutional peculiarities of the dual education system provide random variation in the actual day of labor market entry, which will be exploited to separate true wage returns from spurious correlations.

Instable employment patterns during the early career might partly be the result of individual choices, like the decision to participate in further education after graduating from

apprenticeship training. Career success is also likely to differ because of fundamental differences in individuals' ability and motivation, for instance. Consequently, identification of true wage returns requires random variation in the number of days worked during young adulthood. To this end, I isolate an exogenous source of variation in early employment stability by exploiting differences in the overall economic environment that graduates face during their first years in the labor market. More specifically, I focus on those apprentices who graduated right *before* the start of a recession. The associated economic downturn affects otherwise identical workers at different points in their early career. Being hit by such a macroeconomic shock earlier in the young career rather than later is relevant for employment stability because workers are more prone to adverse economic conditions the less time they have spent in the labor market, cf. Blanchflower and Oswald (1994). The variation in the timing of shocks also arises solely because of differences in the time of graduation from the dual education system. Due to peculiarities of the institutional framework, the actual date of labor market entry varies among graduates from the same cohort even if they have been trained by similar firms and in the same occupation. The individual day of graduation can therefore be viewed as exogenous in the wage-setting process once cohort and training-occupation fixed effects are controlled for. Consequently, the differences in the national economic environment exploited here can be considered ignorably assigned. Furthermore, because identification is solely based on aggregate shocks, any issues related to systematic regional sorting are avoided since no variation in local labor market states is involved. Adult wages in turn are measured under similar economic conditions, and every graduate considered will have endured the same downturn at that time. Therefore, the type of variation exploited here should affect wages several years after graduation exclusively through disrupting the employment process early on.[2]

This study contributes to the existing literature in at least three ways: First, Neumark (2000) summarizes evidence for workers on the U.S. labor market, and concludes that there is no clear trend towards a decline in long-term employment relationships. Stuart (2002), however, points out that lacking time consistency of employment measures is often considered a serious problem. Bernhardt, Morris, Handcock and Scott (1999), explicitly addressing this issue, report decreasing job stability for young white men in the U.S., and Monks and Pizer (1998) show an increase in the probability of involuntary job change among American young people during the 1970s to 1990s. Evidence for Europe in general, and for Germany in particular, is even more diverse, as Bergmann and Mertens (2011) show in an extensive literature review. One possible explanation for these deviating findings might be that the decline in stability does not affect all young workers: while among the group of male German apprenticeship graduates studied here it is only the employment durations which were comparatively short already which have been declining since the late 1980s, durations of medium length have even been slightly prolonged.

Second, I complement the literature on interactions between career trajectories and (early) labor market conditions, like e.g. von Wachter and Bender (2006), Davis and von Wachter

[2] To make sure that results are not confounded by persistent differences in the quality of initial jobs, in a robustness check the sample is restricted to workers who have changed their employer after the end of the early career stage. This restriction should disable a possible direct connection between persistent match quality and adult wages, cf. Neumark (2002).

(2011), or Adda, Dustmann, Meghir and Robin (2013), by estimating wage and employment effects of experiencing a macroeconomic shock at different points in a career which is still in its early stages. Being hit by such a shock at an early stage rather than later impairs the individual professional development considerably more for younger cohorts than for older cohorts, *ceteris paribus*.

Finally, this analysis contributes to the literature on state dependence between past labor market experiences and future labor market outcomes. Existing studies do not derive a uniform conclusion as to whether stable employment early in professional life has positive effects on wages in future periods. While Gardecki and Neumark (1998), for instance, find no significant wage returns to early job stability for workers in the U.S., Neumark (2002) reports substantial returns.[3] The detailed administrative data at hand allow me to extend existing identification strategies, which usually rely on variation in local economic conditions prevailing at labor market entry and do often not observe the exact date of graduation. Moreover, the long panel dimension of the data is exploited to study how the returns to early-career employment stability vary across the adult wage distribution within cohorts, how they evolve at different points of the wage distribution between cohorts, and how long they persist as the professional career develops.

This article proceeds as follows: The next section describes the data set, defines variables, and characterizes the distributions of youth employment and adult wage. Section 3 discusses methodological issues and outlines the empirical strategy, while Section 4 presents and interprets the regression results. The main goal of Section 4 is to identify true state dependence between early-career employment stability and wages in prime age. Additionally, the section explores whether the returns vary over the wage distribution, investigates the degree of persistence, contrasts the returns to early-career employment stability with the returns to further educational achievement, and discusses several underlying economic mechanisms. Section 5 concludes.

2 Data, Measures, and Descriptives

2.1 Data

The empirical analyzes in this paper are based on the weakly anonymous version of the 2 percent random Sample of Integrated Labor Market Biographies (SIAB) provided by the Research Data Centre (FDZ) of the Federal Employment Agency (BA) at the Institute for Employment Research (IAB) located in Nuremberg, Germany. The SIAB consists of process-generated data from different sources used by Germany's social security agencies to calculate social security contributions and unemployment benefits, which makes them highly reliable. These data contain comprehensive information on complete labor market biographies and socio-demographic characteristics depicted exact to the day. They provide

[3] Closely related is also the extensive literature on "scarring" effects of youth unemployment, cf. for instance Ryan (2001), Arulampalam (2001), Gregg (2001), Gregg and Tominey (2005), Schmillen and Umkehrer (2013), or Möller and Umkehrer (2015) among many others. This literature frequently reports adverse effects of youth unemployment on adult labor market outcomes.

the basis for many popular studies on German labor market issues, such as those by von Wachter and Bender (2006), Dustmann, Ludsteck and Schönberg (2009), or Card, Heining and Kline (2013). As a further extension, establishment data from the Establishment History Panel (BHP), which contains annual information on all German establishments with at least one worker in employment that is covered by social security on June 30th, are also merged with the SIAB. For a detailed description of the BHP, see Gruhl, Schmucker and Seth (2012), and likewise for the SIAB, see vom Berge, König and Seth (2013).

The basic sample selection restricts the empirical analysis to males of German nationality who graduated from the dual education system in West Germany.[4] Mincer (1962) characterizes the period of schooling prior to an apprenticeship as a preparatory stage. The occupational skills conveyed during training are also widely unspecific [see Winkelmann (1996), or Harhoff and Kane (1997)]. This renders graduation from the dual education system an ideal starting point for the analysis of consequences of early labor market shocks [see also the discussion in von Wachter and Bender (2006)]. Since they might hardly be comparable to the rest of the sample in terms of unobserved heterogeneity, all individuals who hold a high school diploma at the time of graduation are excluded, which is the case for about 9 percent of all graduates in the pooled sample. On the one hand, the remaining group is quite homogenous in regard to former labor market experience, professional background, and future expectations. On the other hand, about 60 percent of all individuals who enter the German labor market each year go through this system. Therefore, the selected sample is still representative of an important part of the German workforce. Further details on data cleansing and sample selection can be found in Appendix 6.1.

2.2 Measures

In the baseline scenario, the key regressor – early-career employment stability – is constructed by adding up all the days that an individual was registered as being employed full time and subject to social security contributions during the period between the start of the second and the end of the fifth year of potential experience. This measure captures the overall on-the-job experience accumulated within a stage of the career that is commonly seen as being decisive for professional development. Since early spells of both employment and unemployment are generally short for German apprenticeship graduates, right-censoring of the key regressor should be less of an issue [see von Wachter and Bender (2006)]. Furthermore, the first year of potential experience is excluded in this baseline specification because periods of initial job searching or military service might blur the picture of stability.[5]

The dependent variable of interest is the wage level achieved during a more settled stage of the career. In the baseline specification, the adult wage is defined as the log of the real daily gross wage from dependent employment in the eighth year that has passed since

[4] This system combines on-the-job training in apprenticeships and vocational education at school [see Hippach-Schneider, Krause and Woll (2007)]. Periods in the dual education system are recorded in the SIAB because apprentices have to pay social security contributions.

[5] Appendix 6.3 presents several alternative measures of employment or wages, respectively.

graduation.[6] In the case of parallel employment spells at one point in time, only the spell with the highest wage is considered. If there are multiple spells recorded in that year, an average wage is calculated with the relative duration of the corresponding spell as weight. Finally, wages are deflated to 2005 EUR using the CPI provided by the German Federal Reserve [see Deutsche Bundesbank (2012)].

2.3 Adult Wage Inequality and Early-Career Employment (In-)Stability

Before turning to the estimation of wage returns, this section characterizes changes in the distributions of adult wages and early-career employment stability between apprenticeship graduates from different graduation periods. The goal is to explore the evolution of wage inequality in prime age and employment instability during early career, respectively.

Concerning wage inequality, the adult wage distributions become more dispersed over time. This is illustrated in Figure 1, which plots the difference of the quantiles at each percentile of the adult log wage distributions between two particular graduation periods. Specifically, cohorts from the periods 1977-1979, 1987-1989, and 1999-2001 are contrasted. The comparison focuses on these cohorts, defined by calendar year of graduation, because they enter the labor market at similar points in the business cycle; i.e. in the three years *prior* to a recession, which is why they are also subject of investigation in the regression analyzes. The median growth is subtracted to keep the location of each wage growth distribution constant.

The adult wage distribution remained fairly stable during the 1980s. In most cases, the quantiles do not differ significantly from each other. It is only below the 35th percentile and above the ninth decile that significant but comparatively small declines in wage growth can be observed. The pattern in the lower tail is very similar to what was found for prime-aged male full-time workers in Germany by Dustmann, Ludsteck and Schönberg (2009). One noticeable difference is that the wage growth in the upper tail had not yet accelerated during the 1980s in the case of the subpopulation of apprenticeship graduates studied here. However, this is exactly what can be observed between the late 1980s and the late 1990s: While the quantiles above the median increase, the ones below the median decrease further during that time period. The comparison between the cohorts from the late 1970s and the late 1990s provides a similar picture, suggesting that most distributional wage changes took place during the 1990s.

Turning to the distribution of youth employment, Figure 2 depicts the growth rates of the quantiles at each percentile of the distribution of early-career employment stability between cohorts from different graduation periods.[7] About 15 percent of the individuals in a given

[6] Both the wage–experience and the employment–experience profiles evolve concavely over the working life cycle [Table 7 in Appendix 6.2]. The probability of an employer change, in contrast, drops convexly over the first eight to ten experience years and falls linearly toward zero afterwards. Therefore, the wage level that is achieved in the eighth year on the labor market serves as outcome variable in the baseline scenario.

[7] More intuitively, Figure 2 shows the change in the number of days worked during youth between graduates from different periods at a given position in the employment distribution, relative to the older period. Figure 1 gives the same picture for wages in adulthood. Some of the numbers underlying the figures can be found in Table 8 in Appendix 6.2.

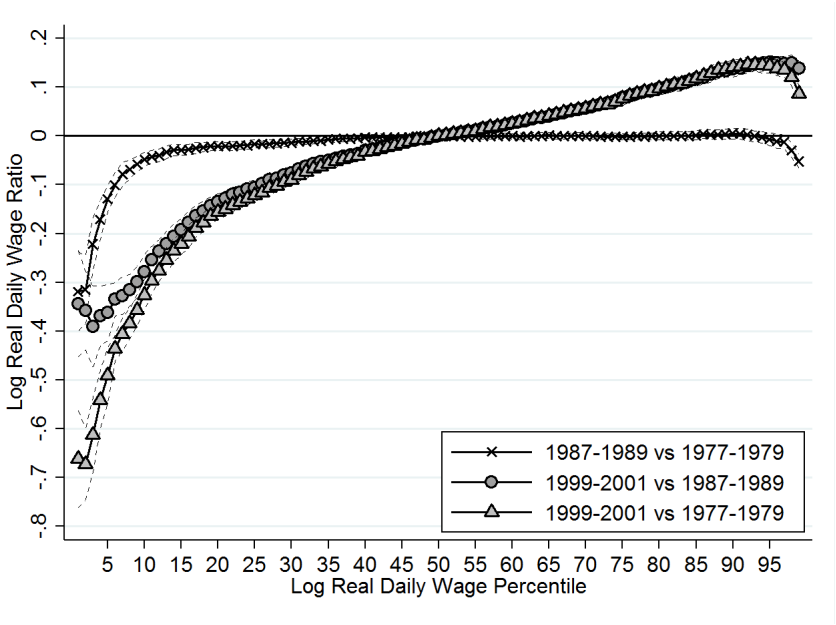


Figure 1: Wage Growth across the Adult Wage Distribution between Graduation Periods

Notes: The figure plots the growth rate of the adult wage at each percentile, indexed to the median growth; the adult wage is measured as the log of the real daily gross wage in the eighth year of potential experience; the cohorts are pooled over the respective graduation period; dashed lines indicate 95% robust confidence intervals.

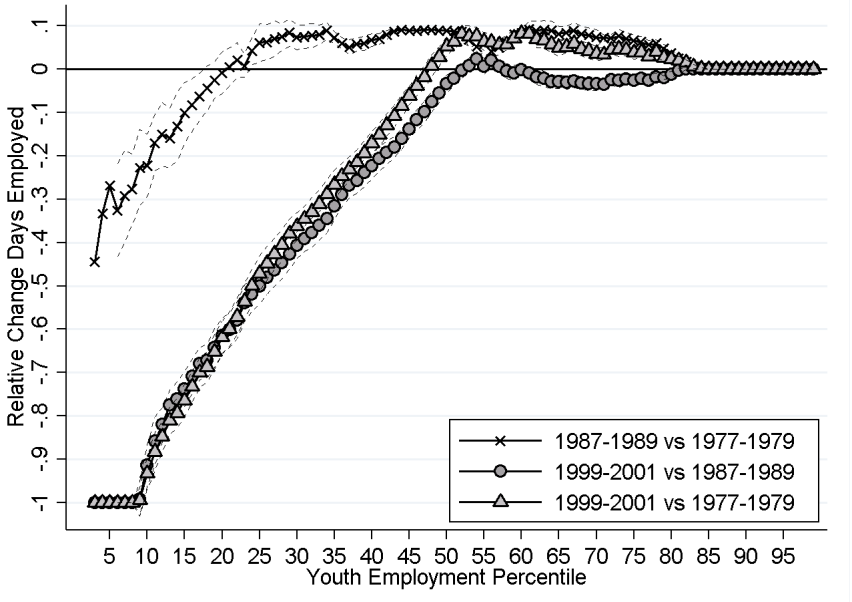


Figure 2: Employment Growth across the Youth Employment Distribution between Graduation Periods

Notes: The figure plots the growth rate of youth employment at each percentile; youth employment is measured as the total number of days in covered full-time employment between the start of the second and the end of the fifth year of potential experience; the cohorts are pooled over the respective graduation period; dashed lines indicate 95% confidence intervals.

cohort are continuously employed in full-time jobs during their early career, irrespective of the time period under consideration. The probability of not experiencing a single day of full-time employment during the early stage increases from 2 percent in the late 1970s and late 1980s to 8 percent in the late 1990s. During the 1980s, employment durations of medium length have moderately increased while durations below the lower quartile have started to decrease significantly. During the 1990s, the decline in employment durations which were already comparatively short continued, whereas upper-tail inequality remained more stable. Again, most of these distributional changes have taken place since the late 1980s.

Further note that the decline of employment durations of younger workers in Germany is not limited to apprenticeship graduates, and cannot therefore be easily explained by changes in the selection into apprenticeship training over time: Rhein and Stüber (2014) also use the IAB's administrative data to document a reduction in the average length of employment relationships of roughly 22 percent between 1975 and 2009 among the general West-German workforce. Entirely consistent with the current findings, declines among workers with no formal vocational qualification are even more pronounced.

Moreover, Rhein and Stüber (2014) observe an increasing rate of temporary working contracts, while Levenson (2000) finds the rate of involuntary part-time employment to have grown in the U.S. since the 1970s, particularly for young and low-skilled men and women. Concurring with Levenson (2000), Table 9 in Appendix 6.2 shows a remarkable increase in the incidence of part-time work between the cohorts of apprenticeship graduates studied here, a phenomenon that will be further addressed in Section 4.2.2. Besides alternative forms of employment gaining in importance, further possible explanations for declining employment stability accompanied by rising wage inequality comprise i) technological progress increasing the substitutability of certain tasks with capital, and enhancing the demand for specific skills that are complementary to capital [cf. Autor, Levy and Murnane (2003), Spitz-Oener (2006), or Acemoglu and Autor (2011)]; ii) rising incentives for educational investment inducing shifts toward higher educational attainment [cf. Altonji, Bharadwaj and Lange (2012)]; iii) growing internationalisation complicating the formation of stable and productive employer-employee relationships, particularly for young low-skill workers [cf. Abraham and Taylor (1996), Dube and Kaplan (2010), Smith (2012), or Card, Heining and Kline (2013)]; and iv) strict employment protection legislation prolonging the duration of both employment and unemployment by reducing employment terminations, and hampering job creation [cf. OECD (1999), or Pissarides (2001)]. The sharp decline in German coverage rates of collective bargaining agreements after the turn of the century, in contrast, can explain a substantial proportion of the increase in upper-tail wage inequality, but much less of the increase in lower-tail wage inequality [see Dustmann, Ludsteck and Schönberg (2009), or Antonczyk, Fitzenberger and Sommerfeld (2010)]. Since unions not only stabilize employment for insiders but also increase turnover, particularly among young workers [see Medoff (1979)], the impact of declining coverage on employment stability is ex-ante undetermined. However, an empirical investigation of the reasons for growing employment instability would go beyond the scope of this paper and is therefore left for future work.

3 Conceptual Considerations

3.1 Confounding Factors

The previous section has demonstrated that the decline in youth employment durations since the late 1980s has coincided with an increase in adult wage inequality. Of course, this coincidence does not necessarily reflect a structural relationship. The main theoretical argument for the existence of such a structural relationship between current employment and future wages, however, is true state dependence, as defined by Heckman and Borjas (1980). More specifically, wage differences as a consequence of periods of interrupted employment in the past among otherwise identical individuals are commonly explained by skill depreciation during joblessness [see Pissarides (1992), or Acemoglu (1995)], and negative signaling [see Vishwanath (1989), or Gibbons and Katz (1991)].[8] Since many presumably relevant factors are usually not observable in practice, it is highly challenging to separate true state dependence from spurious correlations in empirical work. However, this is exactly what is needed to identify true wage returns to early-career employment stability.

A basic linear regression model,

$$w_{i,c,a} = \bar{w} + \alpha_{c,a} d_{i,c,y} + \mathbf{x}_{i,c,g}^{\top} \beta_{c,a} + o_{i,c,a}, \tag{1}$$

explains the real log daily gross wage, $w_{i,c,a}$, of individual i in cohort c after a years in the labor market by $d_{i,c,y}$, the overall work experience accumulated during youth y, which is a period that lies between g and a, and an error term, $o_{i,c,a}$. Also included are a constant, $\bar{w}$, and a column vector of explanatory variables, $\mathbf{x}_{i,c,g}$, which are determined shortly before the time of graduation g. $\beta_{c,a}$ is a column vector of parameters and $\alpha_{c,a}$ represents the true return to employment stability in terms of wages gained after a years of potential experience.

The goal is to consistently estimate $\alpha_{c,a}$. However, as pointed out by von Wachter and Bender (2006), a proper analysis of the youth labor market has to take three key mechanisms into account: Initial sorting of apprentices between firms, adverse selection within firms, and individuals' voluntary mobility. Concerning initial conditions, it has been documented that more productive firms provide more stable jobs and pay higher wages [cf. Abowd, Kramarz and Margolis (1999) for France, or Card, Heining and Kline (2013) for Germany]. If these firms select their trainees more thoroughly, too, the presence of non-random sorting would introduce an upward bias in the estimates of $\alpha_{c,a}$, at least as long as differences in initial conditions that persist over a years of potential experience are not adequately controlled for.

In the present case with graduation from the dual education system defining a clear and observable point of labor market entry, systematic sorting of apprentices into training firms

[8] Further explanations include lowering of reservation wages during joblessness, the presence of career ladders, implicit contracting, labor unions, hiring and firing costs, discouragement or habituation effects, lack of physical capital after recessions, or different bargaining powers of insiders and outsiders [see von Wachter and Bender (2006), or Schmillen and Umkehrer (2013) for further references].

can be explicitly accounted for by including a rich set of control variables characterizing both the training relationship as well as the firm providing the training. Since these control variables are measured before labor market entry they can arguably be considered exogenous. Extracted from the last spell before an individual's graduation from the dual education system and included in $\mathbf{x}_{i,c,g}$ are: a polynomial of second order in graduation age, dummy variables for three-digit training occupations, dummy variables for three-digit industry sectors, dummy variables for the graduation cohort, a dummy variable indicating a delayed report of the day of graduation, the size and real log median wage of the training firm, and the local unemployment rate in the district of the training firm. Additionally, the aggregate unemployment rate in the year of the wage observation is the only control variable measured after graduation. Appendix 6.1 provides further details on variable definitions.

Besides initial conditions, there are of course many more factors involved in the wage setting process. These factors are subsumed in the error term of Equation (1). A consistent estimation of $\alpha_{c,a}$ from Equation (1) is still possible as long as there are no correlations between the error term, youth employment and adult wage. However, Franz and Zimmermann (2002) analyze the training-to-work transitions in the dual education system: From the employer's point of view, the period of training serves as a screening device. As a consequence only those apprenticeship graduates who are expected to generate positive net returns in the future are retained with the company. This type of negative selection of leavers would lead to upward biased estimates of $\alpha_{c,a}$ as long as the associated layoff persistently reduces the quality of potential job offers in the future in terms of wages and stability, e.g. due to stigma effects. The young graduate, in turn, decides whether he wants to stay with the training firm or to leave in order to find better matches or to participate in further education, for instance. Adda, Dustmann, Meghir and Robin (2013) e.g. provide evidence that job mobility among young workers is an important determinant of wage growth, next to on-the-job training. Such a trade-off of employment stability against mobility would induce a downward bias in the estimates of the return to early-career employment stability if workers with higher returns to search or education are also more likely to become mobile [cf. Neumark (2002)].[9] Consequently, raw estimates of the return to stability might be biased in an ex-ante unknown direction.

3.2 Identification Strategy

One way to circumvent the potential endogeneity problems outlined above is to focus on the fraction of the variation in youth employment that is induced by exogenous shocks. If these shocks impact wages in adulthood exclusively through early (un-)employment experiences, true wage returns can be identified [cf. Angrist, Imbens and Rubin (1996)]. The variation considered here is induced by a macroeconomic shock affecting otherwise identical workers at different points in their early career. To this end, I restrict the sample to

[9] A more fundamental form of bias arises from the fact that wages are not observable for every worker in every year. In the present case of male apprenticeship graduates, sorting in unemployment should be the main reason for not observing a wage. As will be shown in Section 4.2.2, the returns to early-career employment stability are particularly pronounced at the bottom of the wage distribution. Since the unemployed can plausibly be expected to be over-represented among workers with the lowest earning potential, sample selection should lead to a downward bias in estimates of the returns to stability; i.e. the estimates of the returns derived from the selected sample are likely to represent a lower bound estimate of the true returns.

workers who graduated from the dual education system in the three years *prior* to a recession. The data sufficiently cover three recessions: the recession around the year 1982 as a consequence of the second oil crisis, the recession around the year 1992, which was induced by the end of the post-reunification boom, and the recession around 2004, which was caused by the burst of the Internet bubble. The analysis can therefore be repeated three times; for apprentices graduating 1977-1979, 1987-1989, and 1999-2001.

What is needed next is a measure of macroeconomic conditions. Because both employment and unemployment spells are recorded in the SIAB to the exact day, it is possible to calculate unemployment rates at the national level for each day from the first day of January in 1975 to the last day of December in 2010 from the SIAB's full sample. The final measure used in the following calculations is the aggregate unemployment rate (UR) averaged over a worker's early career (y), which is denoted as $UR_{e,y}$.[10] This measure varies with the calendar day of labor market entry (e). This is important because, as will be discussed below, the dual education system predetermines the actual time of labor market entry within cohorts and occupations. Controlling for cohort and occupation fixed effects is therefore indispensable, which in turn implies that the measure has to vary within cohorts and occupations. Furthermore, any issues related to systematic regional sorting are avoided since no variation in local labor market states is involved.

For those workers who entered the labor market in the three years *prior* to a recession, $UR_{e,y}$ reflects an adverse macroeconomic shock affecting individuals at different points of their early career cycle. To illustrate this idea, Figure 3 plots the level and the one-year moving average of the aggregate unemployment rate by calendar day. The three graduation periods considered are marked in Figure 3, as are the corresponding periods during which the wage outcome is measured. The later a worker graduates within one of the periods, the earlier he will be confronted with a rise in unemployment during his early career. Because workers are more prone to adverse economic conditions the less time they have spent in the labor market, cf. Blanchflower and Oswald (1994), establishing a stable employer–employee relationship can be expected to become harder if economic conditions are unfavorable early on. For this reason, $UR_{e,y}$ is relevant for employment stability in a sense that it has an effect on the maximum number of days in employment attainable during youth.

Furthermore, $UR_{e,y}$ varies exclusively with the day of graduation. For a given cohort of labor market entrants, this day can be assumed to be exogenous in the process of adult wage determination because it can hardly be manipulated neither by the individual nor by the training firm for the following reasons: According to section 21 of Germany's Vocational Training Act (Berufsbildungsgesetz - BBiG, 2005), the day of graduation is the day on which the apprentice *is informed* of the outcome of the final examination by the board

[10] Specifically, the calculation of the unemployment measure is carried out in three steps: First, the aggregate unemployment rate, UR_d (in percent), prevailing on calendar day d is calculated from the SIAB. Because the SIAB does not cover periods of official job searching before the year 2000, unemployment has to be identified via the receipt of unemployment benefits. However, about 90 percent of workers who are registered as unemployed are eligible to receive unemployment benefits. Next, moving-averages over the following $x = 365$ days are calculated as $UR_{e,p} = \frac{1}{x}\sum_{t=d+xp-x}^{d+xp-1} UR_t$. Merged by the first day of each year of potential experience, $UR_{e,p}$ varies with the year of potential experience p and an individual's day of labor market entry e. Finally, averaging over the individual's early career y yields $UR_{e,y} = \frac{1}{4}\sum_{p=2}^{5} UR_{e,p}$.

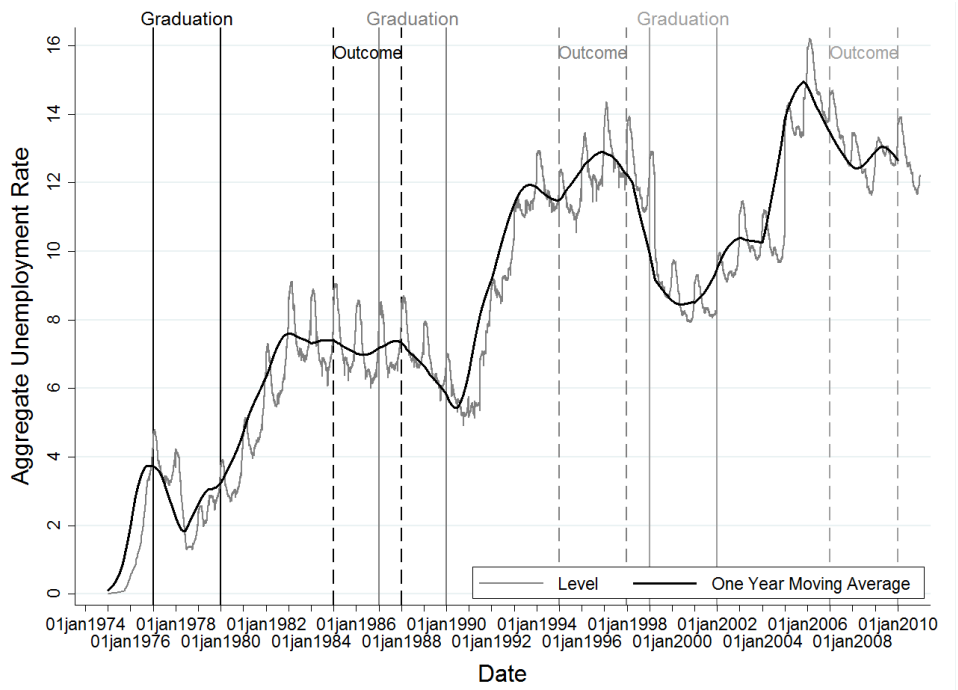


Figure 3: Aggregate Unemployment Rates by Date (in %)

Notes: The figure plots the aggregate unemployment rate prevailing on each day from the first day of January in 1975 to the last day of December in 2010, calculated from the SIAB's full sample.

of examiners. The employment status of the former apprentice, which is recorded in the SIAB, is also updated on this day. Examination dates themselves are in turn predetermined by the competent authority responsible for a specific training occupation, e.g. by different Chambers, such as the Chamber of Industry and Commerce. Because final examinations usually take place twice a year, because the timing of additional oral or practical tests might differ, and because the behavior of the local board of examiners regarding communication of the results can vary randomly, the day of graduation varies even within cohorts and narrowly defined training occupations.

Additionally, for a consistent estimation of the true wage returns to early-career employment stability, $UR_{e,y}$ is allowed to impact the adult wage only indirectly via disturbing the early employment process. This exclusion restriction prohibits any persistent wage effects of differences in the timing of the shock other than through individual employment loss. In this particular case, it is plausible that the exclusion restriction holds because, on the one hand, all workers considered here had to suffer through a recession at some point of their early career. Consequently, everyone has lived through the same economic changes that have taken place until the wage outcome is measured. Wages again are measured under similar economic conditions [as suggested by Gregg (2001) the aggregate unemployment rate in the year of the wage observation, $UR_{e,a}$, is included among the control variables]. On the other hand, being confronted with an economic downturn earlier rather than later in youth also leaves more time to recover under more favorable macroeconomic conditions afterwards. During the first eight years of potential experience, young graduates who had to struggle with low labor demand earlier on therefore still would have had the opportunity to catch up in all other areas apart from foregone work experience. Consistent with this

view, Adda, Dustmann, Meghir and Robin (2013) report that mobility rates among young German apprenticeship graduates increase temporarily right after recessions. The validity of the exclusion restriction is further discussed in Section 4.1.1.

The identification strategy ultimately combines the measure of macroeconomic conditions, cohort/occupation fixed effects, and the timing between graduation and recession. It is implemented as an instrumental variable (IV) estimator. Since the instrumental variable $UR_{e,y}$ varies with the day of graduation, controlling for cohort effects as well as for the sorting into three-digit training occupations remains feasible. Holding initial conditions and cohort effects constant, the IV strategy exploits random variation in aggregate economic conditions prevailing at different stages of the early career cycle within the occupation cohorts. Specifically, it contrasts workers who graduated in the same occupation, from similar firms, under similar regional conditions, and in the same calendar year, but entered the labor market at different dates throughout the year.

The IV first-stage regression isolates the variation in early employment stability that is induced by the instrument:

$$d_{i,c,y} = \bar{d} + \pi_{c,y} UR_{e,y} + \mathbf{x}_{i,c,g}^{\top} \psi_{c,y} + \epsilon_{i,c,y}. \tag{2}$$

The reduced form

$$w_{i,c,a} = \tilde{w} + \rho_{c,a} UR_{e,y} + \mathbf{x}_{i,c,g}^{\top} \iota_{c,a} + \eta_{i,c,a} \tag{3}$$

gives the instrument's effect on adult wage. The reduced-form and first-stage effects of the instrument, ρ and π respectively, are interesting in themselves because they can be interpreted as the wage and employment effects of experiencing a recession at different points in a career which is still in its early stages. Furthermore, these effects can be estimated for different graduation periods and their estimates are consistent even without an exclusion restriction. Under the additional exclusion restriction, however, $\hat{\alpha}_{c,a} = \hat{\rho}_{c,a} / \hat{\pi}_{c,y}$ provides a consistent estimate of the true return to early-career employment stability.

4 Returns to Early-Career Employment Stability

4.1 Baseline Estimates

As mentioned above, there may be several mechanisms confounding estimates of the returns to stable employment experienced early in professional life. Still, the raw wage effect, i.e. the coefficient estimate of youth employment in a regression of adult wage including only a constant as additional explanatory variable, serves as a useful benchmark. It is therefore reported in Table 1. Ultimately identifying true wage returns, Table 1 further summarizes regressions instrumenting early-career employment stability with the average aggregate unemployment rate prevailing during youth. The two-stage least squares (TSLS) procedure is applied. Besides coefficient estimates of youth employment the table also reports the first-stage and the reduced-form effects of the instrument (see the previous section for details). All the regressions are carried out for workers graduating from Germany's dual education system in 1977-1979, 1987-1989, and 1999-2001 separately. Robust standard errors and robust first-stage F-statistics are displayed, too.

Table 1: Regressions of Log Real Daily Adult Wage by Year of Graduation

	(1)	(2)	(3)	(4)	(5)	(6)
Cohorts	1977-1979		1987-1989		1999-2001	
Method	OLS	TSLS	OLS	TSLS	OLS	TSLS
Regressions of adult wage						
Youth employment [$\cdot 10^4$]	1.376···	0.842	1.737···	2.709··	3.266···	4.135···
	(0.067)	(1.470)	(0.076)	(1.299)	(0.097)	(1.003)
TSLS reduced form – regressions of adult wage						
$UR_{e,y}$	—	-0.008	—	-0.038··	—	-0.072···
		(0.016)		(0.019)		(0.019)
TSLS first stage – regressions of youth employment						
$UR_{e,y}$	—	-105···	—	-143···	—	-175···
		(25.7)		(26.9)		(22.9)
Robust F-statistic		16.9···		28.6···		59.3···
Test of endogeneity						
Robust score $\chi^2(1)$	—	0.024	—	0.852	—	2.064
Other variables included in regressions						
Constant	yes	yes	yes	yes	yes	yes
Control variables	no	yes	no	yes	no	yes
Observations	12,657	12,657	12,024	12,024	8,030	8,030

Notes: Robust standard errors in parentheses; *, (**), [***] indicate significance at the 10, (5), [1] percent level; the adult wage is measured as the log of the real daily gross wage in the eighth year of potential experience; youth employment is measured as the total number of days in covered full-time employment between the start of the second and the end of the fifth year of potential experience; the instrument is the aggregate unemployment rate averaged over the second to fifth experience year ($UR_{e,y}$); [$\cdot 10^4$] indicates that the corresponding coefficient estimates were multiplied by 10,000; for variable definitions, see Section 3.2 and Section 6.1.

In the mean, wages after eight years in the labor market and the total number of days in full-time employment during youth are positively and significantly related in each of the three graduation periods. This can be seen from the raw wage effects reported in columns (1), (3), and (5) of Table 1. The relationship between youth employment and adult wage is more pronounced among younger cohorts. However, for several reasons outlined in Section 3.1, these simple estimates might be biased in an ex-ante ambiguous direction.

To account for differences in initial conditions, the regressions summarized in columns (2), (4), and (6) of Table 1 control for the rich set of firm- and worker-related characteristics mentioned in Section 3.1. In particular, they include dummies for the calendar year of graduation and the occupation trained. Furthermore, the regressions instrument youth employment with the average aggregate unemployment rate prevailing during early career, $UR_{e,y}$. Under the assumptions discussed in the previous section, this approach separates true state dependence between adult wage and early-career employment stability from any remaining spurious correlations. The 2SLS coefficient estimates can then be interpreted as the average rate of return to one additional day of full-time employment accumulated during youth, evaluated after eight years in the labor market. A better intuition of the size of these effects, however, is given by the average annual rate of return, i.e. the semi-elasticity of adult wage at 365 days of employment within the four years of early career. The average annual rate of return to early-career employment stability among graduates from the late 1970s is roughly 3 percent. The underlying coefficient estimate, however, is not significantly different from zero at the 10 percent level. For workers graduating during the late 1980s, the corresponding annual rate is about 10 percent and significant at the 5 percent level. For graduates from the late 1990s, the annual return increases further to highly significant 16 percent.

In the mean, the returns to early-career employment stability revealed by 2SLS are not only economically important but have also increased during the 1980s and 1990s. The conditional expectation functions estimated above can be contrasted via a classical detailed three-fold oaxaca-blinder decomposition. In this counterfactual analysis, the difference in mean wages between graduates from different periods is decomposed (among other things) into a component attributable to the change in the average return to stability, Δ_d^S, and a component attributable to differences in expected stability levels, Δ_d^C. From the viewpoint of graduates from the late 1990s, relative to graduates from the late 1980s, the former wage structure effect is given by

$$\hat{\Delta}_d^S = \{\hat{\alpha}_{87/89,8} - \hat{\alpha}_{99/01,8}\}\hat{E}[d_{99/01,y}], \tag{4}$$

while the latter composition effect can be calculated as

$$\hat{\Delta}_d^C = \{\hat{E}[d_{87/89,y}] - \hat{E}[d_{99/01,y}]\}\hat{\alpha}_{99/01,8}. \tag{5}$$

As suggested by Fortin, Lemieux and Firpo (2011), the decomposition is performed by substituting the 2SLS coefficient estimates of youth employment from columns (4) and (6) of Table 1 into Equations (4) and (5) respectively to account for endogenous variation in youth employment. The sample means of youth employment reported in Table 6 in the appendix serve as estimates for expected stability. Ultimately, an estimate of -0.125 for

Δ_d^S implies that wages of graduates from the late 1990s would have been on average lower by about 12.5 percent had the returns to early-career employment stability not increased, holding the means of observed and unobserved characteristics – and in particular cohort fixed effects which are included in each wage regression – as well as all remaining returns at the level of the cohorts from the late 1980s. In contrast, the decline in the average number of days worked full time early in professional life during the 1990s has widened the real adult wage gap between the younger and the older cohorts by roughly $\hat{\Delta}_d^C = 5.6$ percent, *ceteris paribus*.

Before turning to a number of specification checks in the next section, taking a closer look at the first-stage and reduced-form effects of the instrument provides some additional insights. As discussed in Section 3.2, the reduced form gives the wage effect of experiencing a recession earlier rather than later in a career which is still in its early stages. The first stage is the corresponding effect on cumulative full-time employment during youth. Interestingly, there is no significant reduced-form effect for cohorts from the late 1970s, conditional on initial conditions. However, the first-stage effect of minus 105 days is highly significant. While experiencing an adverse macroeconomic shock sooner rather than later has reduced contemporary employment durations for cohorts from the late 1970s on average, there were no significant effects on the mean of wages after eight years in the labor market. For the younger cohorts, in contrast, average wage reductions due to a one percentage point increase in the aggregate unemployment rate prevailing during youth – which is close to one standard deviation in each of the three recessions, cf. Table 6 in the appendix – are 3.8 (7.2) percent in the late 1980s (1990s), and significantly different from zero after eight years. The corresponding average decline in total youth employment increases from 143 days in the late 1980s to 175 days in the late 1990s. What is more, the return to early-career employment stability is the reduced form divided by the first stage in the just-identified IV case. Consequently, the return to stability increases between the cohorts studied here because the wage declines in adulthood induced by experiencing a recession earlier on increase faster than the corresponding employment declines in adolescence.

4.1.1 Specification Tests

This section presents a number of specification tests to assess the validity of the identifying assumptions stated in Section 3.2. First of all, experiencing a recession at an earlier point in the still young career has to be relevant for early-career employment stability. The significantly negative first-stage effects reported in Table 1 confirm this relevance. Since the first stage F-statistics are also larger than ten, weak instrument problems can be ruled out [see Stock, Wright and Yogo (2002)].

Concerning ignorable assignment, the reason for termination of a training contract is not explicitly recorded in the SIAB. Systematic drop-outs might therefore induce endogenous variation in the day of graduation. According to the Bundesinstitut für Berufsbildung [BIBB, Federal Institute for Vocational Education and Training (2014)] more than 80 percent of all drop-outs between 1993 and 2012 occurred during the first two years of training. Consequently, the estimation sample can be restricted to apprentices who have spent at least a

certain time in training to minimize the potential influence of drop-outs. The output summarized in columns (1) and (2) of Table 2 replicates regression (6) of Table 1 but restricts the sample to apprentices who have been trained for at least one or two years, respectively. While the estimated returns vary somewhat between the different specifications the results are qualitatively very robust.

Posing a second potential risk for ignorability, final examinations usually take place twice a year. Since an average of 13 percent of males who participated in final examinations in West Germany between 1993 and 2012 failed, non-random sorting of apprentices into examination dates within a calendar year might occur. Addressing this concern, year fixed effects are replaced by half-year fixed effects in specification (3) of Table 2. Including these more differentiated cohort effects controls for systematic differences between those apprentices who take the final exam in the first half or the second half of a calendar year respectively. Again, however, the results are qualitatively robust.

Finally, the exclusion restriction would be violated if the deterioration of the job-offer distribution induced by the instrument were permanent due to reasons other than individual youth employment instability. In this case, the wage differences in adulthood revealed by 2SLS would partly be a consequence of persistent differences in the quality of initial jobs. As outlined by Neumark (2002), the sign of this bias depends on the direction of the correlation between the instrument and the quality of matches, and is therefore ex-ante undetermined. Neumark (2002) further suggests addressing this potential problem by restricting the analysis to mobile workers. To do so, specification (4) of Table 2 is estimated for individuals who no longer work for the same employer at the end of the seventh experience year as at the end of the fifth experience year. The idea behind this test is that a direct connection between persistent match quality and adult wage is disabled once individuals change employer. The return derived from the sample of movers, however, is somewhat larger than in the unrestricted sample. Concurring with Neumark's (2002) findings, any correlation of the instrument with unobserved match quality appears to bias the IV estimates, if at all, toward finding no beneficial returns to stability.

Although the estimates vary slightly between the different specifications, the main result of statistically and economically significant returns to stable employment early in the career is left unchanged. This robustness suggests that the identifying assumptions are not crucially violated in the present application.

4.2 Additional Estimates

Mean regression methods applied so far implicitly assume that the return to early-career employment stability is constant across the wage distribution and therefore independent of workers' general earning potential. As was shown in Section 2.3, both employment instability and wage inequality have increased asymmetrically between the cohorts studied here. In light of this development it seems likely that the return to stability varies with the position in the wage distribution. Quantile regressions are applied in Section 4.2.2 in order to test this hypothesis. To this end, an alternative wage model is used instead of the system of equations analyzed in the previous section. This model is presented together with its

Table 2: Regressions of Log Real Daily Adult Wage (Specification Tests)

	(1)	(2)	(3)	(4)
Cohorts	1999-2001			
Method	TSLS	TSLS	TSLS	TSLS
Specification	Length of training at least one year	Length of training at least two years	Half-year fixed effects	Change of employer exp. years six or seven
TSLS second stage – regressions of adult wage				
Youth employment [$\cdot 10^4$]	3.537$^{\cdots}$	4.085$^{\cdot\cdot}$	3.041$^{\cdot\cdot}$	5.305$^{\cdots}$
	(1.31)	(2.06)	(1.36)	(1.98)
TSLS reduced form – regressions of adult wage				
$UR_{e,y}$	-0.049$^{\cdot\cdot}$	-0.040$^{\cdot}$	-0.058$^{\cdot\cdot}$	-0.077$^{\cdot\cdot}$
	(0.020)	(0.022)	(0.028)	(0.030)
TSLS first stage – regressions of youth employment				
$UR_{e,y}$	-141$^{\cdots}$	-99$^{\cdots}$	-191$^{\cdots}$	-146$^{\cdots}$
	(25.2)	(27.8)	(35.8)	(32.0)
Robust F-statistic	31.6$^{\cdots}$	13.2$^{\cdots}$	29.0$^{\cdots}$	21.8$^{\cdots}$
Other variables included in regressions				
Constant	yes	yes	yes	yes
Control variables	yes	yes	yes	yes
Observations	7,148	5,959	8,030	3,711

Notes: Robust standard errors in parentheses; *, (**), [***] indicate significance at the 10, (5), [1] percent level;
in (1) individuals with an initial training period of less than one year are excluded;
in (2) individuals with an initial training period of less than two years are excluded;
in (3) year fixed effects are replaced by half-year fixed effects;
in (4) individuals who work for the same employer at the end of the seventh experience year as at the end of the fifth experience year are excluded;
the adult wage is measured as the log of the real daily gross wage in the eighth year of potential experience; youth employment is measured as the total number of days in covered full-time employment between the start of the second and the end of the fifth year of potential experience; the instrument is the aggregate unemployment rate averaged over the second to fifth experience year ($UR_{e,y}$); [$\cdot 10^4$] indicates that the corresponding coefficient estimates were multiplied by 10,000; for variable definitions, see Section 3.2 and Section 6.1.

OLS estimates in a preceding step in Section 4.2.1. Furthermore, until now the outcome has been measured after eight years of potential experience. To investigate the degree of persistence in the returns to stability at different points of the wage distribution, this section proceeds by exploring the dynamics over the career cycle within some of the older cohorts. Before concluding, in a last step of the quantile regression analysis the returns to early-career employment stability are contrasted with the returns to further educational achievement.

4.2.1 Modeling Selection and Mobility

Estimating conditional quantile functions is computationally more demanding than estimating conditional expectation functions. This is why quantile regressions presented in this paper are based on the following modification of Equation (1):

$$w_{i,c,a} = \bar{w} + \alpha_{c,a} d_{i,c,y} + \mathbf{x}_{i,c,g}^{\top} \beta_{c,a} + \delta_{c,a} l_{i,c,y} + \mathbf{p}_{i,c,y}^{\top} \zeta_{c,a} + \mathbf{q}_{i,c,y}^{\top} \theta_{c,a} + \mathbf{r}_{i,c,y}^{\top} \lambda_{c,a} + v_{i,c,a}. \quad (6)$$

The dummy variable $l_{i,c,y}$ is added to indicate completion of secondary or tertiary education by the end of the seventh year of potential experience. Furthermore, $\mathbf{p}_{i,c,y}$ ($\mathbf{q}_{i,c,y}$) [$\mathbf{r}_{i,c,y}$] is a column vector of three dummy variables indicating different frequencies of upward (downward) [stable] employer mobility taking place during the early career. Changes of employer are classified according to the difference between the quality of the previous employer and the subsequent employer in one of the following categories: Upward mobility (a measure of job shopping) if the quality of employer increases, downward mobility (a measure of adverse selection) if the quality of employer decreases, and a stable change of employer if the quality of employer remains constant.[11,12] The real median wage of an establishment serves as a proxy for its quality. Note that individual wage growth does not play any role in this classification. This is important because early wages often do not yet reflect productivity. $\delta_{c,a}$, $\zeta_{c,a}$, $\theta_{c,a}$, and $\lambda_{c,a}$ denote the corresponding returns to each of the additional regressors in terms of wages after a years of potential experience. $v_{i,c,a}$ is an idiosyncratic error term.

The purpose of the additional control variables is to account for the processes of job shopping, adverse selection, and further educational attainment explicitly. By reflecting unobserved heterogeneity at the worker and/or the firm level, like differences in innate ability and motivation, these mechanisms are arguably the most important source of bias in an analysis of long-term effects of labor market events early in the career, cf. von Wachter

[11] The probability of successfully participating in secondary or tertiary education during the early career increases from about 6.2 percent for graduates from the late 1970s, to 7.6 percent for graduates from the late 1980s, up to 10.5 percent for graduates from the late 1990s; see Table 9 in Appendix 6.2. Remarkably, the probability of realizing upward employer mobility at least once during the early career remains fairly stable, at around 46 percent between cohorts, while the corresponding probability of downward employer mobility increases from 37.8 percent among the cohorts from the late 1970s to 48.5 percent among the cohorts from the late 1990s.

[12] Stable changes of employer are defined as changes that are accompanied by an absolute real median wage growth between employers below 1 percent. This third category is quantitatively unimportant, and is included in the wage regressions so that workers who stay with their initial employer during their early career form the reference category.

and Bender (2006). Random shocks such as layoffs or plant closures would still induce exogenous variation in the number of days actually worked during youth, especially among the graduates studied here who experience a recession early in professional life. However, the possibility that some endogenous variation remains, e.g. due to measurement error in youth employment or other forms of ability bias, cannot be completely ruled out. Besides, particularly involuntary changes of employer might be a result of employment instability in the past. Switching off some of the channels through which employment stability translates into wages might lower the revealed degree of state dependence and therefore lead to downward bias in the estimated return to stability. For these reasons, estimates of the average rate of return based on Equation (6) might be biased and inconsistent. The results presented below are therefore descriptive in nature.

Despite these concerns, OLS estimates of the return to stability derived from this simpler wage model are not qualitatively different from the 2SLS estimates presented above.[13] As can be seen from Table 3, stable employment during the early career still exhibits positive effects on the mean of wages received in the eighth year since labor market entry, and these returns are substantially higher for younger cohorts.[14] Apparently, any remaining bias does not decisively influence estimates of the average rate of return to early-career employment stability.

Providing some additional robustness, regressions presented in Appendix 6.3 substitute the baseline measure of employment stability (with job stability, occupational stability, and employment continuity) and the baseline measure of wages (with wages restricted to the main job or wages imputed if top-coded), expand the periods of measurement, and restrict the minimum duration of training. It turns out that all these various specifications leave the previous conclusions unchanged.

4.2.2 Heterogeneity in Returns between Cohorts

Returns vary over the adult wage distribution if quantile-specific shocks alter the extent of state dependence. To explore this possibility, quantile functions of wages in the eighth year of potential experience, $Q_\theta(w_{c,8}|.)$, are estimated with Koenker and Bassett's (1978) conditional quantile regressions, whereby $w_{c,8}$ follows Equation (6). As the only exception, quantile functions estimated in this paper reduce three-digit occupations to ten categories according to Blossfeld's (1987) classification, and omit stable changes of employer

[13] This impression is reinforced by the results of a series of endogeneity tests displayed in Table 1. These draw on a robust score χ^2-statistic developed by Wooldridge (1995) to test the null of exogeneity of the regressors in each IV model. None of the tests can reject exogeneity at the ten percent level. According to these test results, OLS would therefore be preferable to 2SLS since OLS estimates are more precise than 2SLS estimates by construction. One plausible explanation for this finding is that most early (un-)employment experiences are exogenously driven by the recession.

[14] Table 3 further contains OLS coefficient estimates of upward employer mobility, downward employer mobility, and further educational attainment. These estimates reveal both economically and statistically significant returns to further educational achievement. Job shopping, in turn, exhibits smaller returns than for further education which only slightly increase with the number of changes of employer. Having to leave a high-quality firm and to start again at a firm of lower quality, in contrast, involves significant future wage declines, which substantially increase with the number of changes of employer in this category.

Table 3: Regressions of Log Real Daily Adult Wage (Augmented OLS Regressions)

	(1)	(2)	(3)
Cohorts	1977-1979	1987-1989	1999-2001
Youth employment [$\cdot 10^4$]	1.069···	1.478···	2.680···
	(0.066)	(0.077)	(0.104)
Further education	0.120···	0.086···	0.159···
during y	(0.013)	(0.014)	(0.019)
Change of employer			
during y [# switches]			
reference: stayer			
Upward [1]	0.035···	0.016···	0.035···
	(0.004)	(0.006)	(0.010)
Upward [2]	0.047···	0.018·	0.045···
	(0.008)	(0.010)	(0.015)
Upward [$>$2]	0.023	0.009	0.030
	(0.015)	(0.016)	(0.024)
Downward [1]	-0.074···	-0.078···	-0.117···
	(0.005)	(0.006)	(0.010)
Downward [2]	-0.113···	-0.148···	-0.166···
	(0.009)	(0.011)	(0.015)
Downward [$>$2]	-0.201···	-0.225···	-0.246···
	(0.016)	(0.018)	(0.021)
Other variables included in regressions			
Constant	yes	yes	yes
Control variables	yes	yes	yes
Stable changes of employer	yes	yes	yes
Observations	12,657	12,024	8,030

Notes: Robust standard errors in parentheses; *, (**), [***] indicate significance at the 10, (5), [1] percent level; the adult wage is measured as the log of the real daily gross wage in the eighth year of potential experience; youth employment is measured as the total number of days in covered full-time employment between the start of the second and the end of the fifth year of potential experience; [$\cdot 10^4$] indicates that the corresponding coefficient estimates were multiplied by 10,000; for variable definitions, see Section 4.2 and Section 6.1.

for computational reasons. Regressions are again carried out separately for apprentices graduating from the dual education system in 1977-1979, 1987-1989, and 1999-2001.

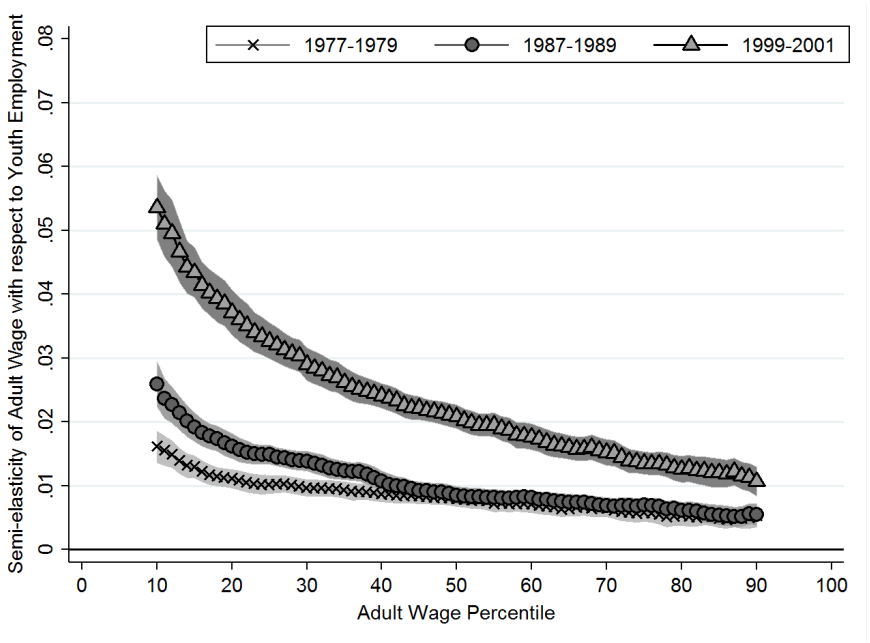
The results are depicted in Panel (a) of Figure 4, which plots the semi-elasticity of adult wage with respect to youth employment against each percentile θ between the first and the ninth deciles of the (conditional) adult wage distribution. The coefficient estimates underlying each decile are presented in Panel (a) of Table 4. The quantile regression estimates re-

Table 4: Regressions of Log Real Daily Adult Wage (Quantile Regressions)

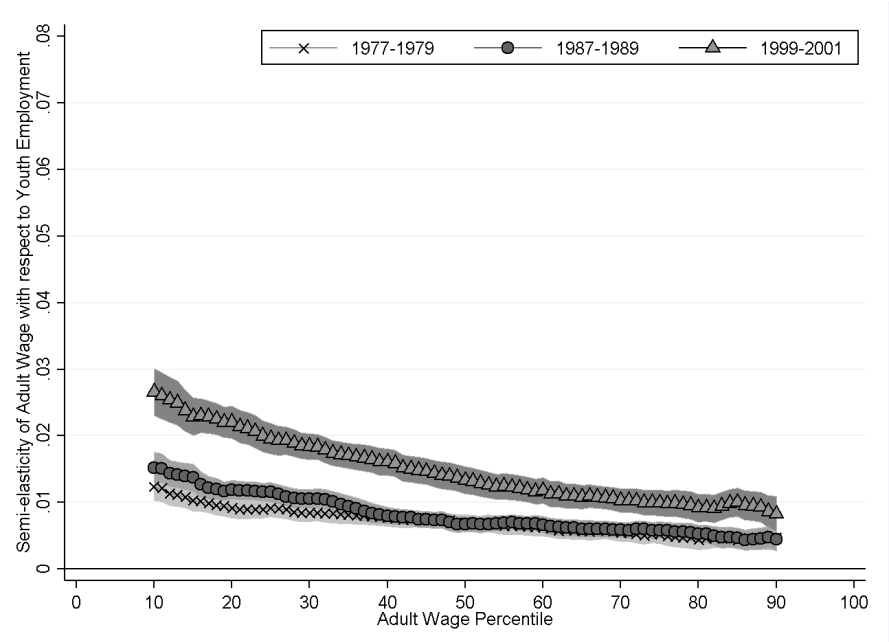
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
					(a) All workers				
Decile	1	2	3	4	5	6	7	8	9
Cohorts					1977-1979 (N = 12,657)				
Youth employment [$\cdot 10^4$]	1.609	1.109	0.964	0.869	0.787	0.701	0.644	0.532	0.531
	(0.125)	(0.075)	(0.065)	(0.064)	(0.056)	(0.063)	(0.067)	(0.078)	(0.089)
Cohorts					1987-1989 (N = 12,024)				
Youth employment [$\cdot 10^4$]	2.592	1.618	1.382	1.070	0.849	0.809	0.689	0.614	0.546
	(0.180)	(0.101)	(0.079)	(0.084)	(0.071)	(0.057)	(0.064)	(0.064)	(0.086)
Cohorts					1999-2001 (N = 8,030)				
Youth employment [$\cdot 10^4$]	5.358	3.714	2.899	2.411	2.083	1.761	1.521	1.257	1.065
	(0.256)	(0.178)	(0.132)	(0.098)	(0.095)	(0.103)	(0.102)	(0.104)	(0.116)
					(b) Full-time workers				
Decile	1	2	3	4	5	6	7	8	9
Cohorts					1977-1979 (N = 12,380)				
Youth employment [$\cdot 10^4$]	1.234	0.912	0.841	0.771	0.698	0.627	0.543	0.446	0.473
	(0.103)	(0.073)	(0.065)	(0.063)	(0.061)	(0.063)	(0.065)	(0.080)	(0.093)
Cohorts					1987-1989 (N = 11,587)				
Youth employment [$\cdot 10^4$]	1.519	1.188	1.058	0.798	0.677	0.668	0.589	0.530	0.445
	(0.122)	(0.072)	(0.073)	(0.065)	(0.062)	(0.063)	(0.061)	(0.069)	(0.086)
Cohorts					1999-2001 (N = 6.996)				
Youth employment [$\cdot 10^4$]	2.660	2.205	1.842	1.612	1.334	1.178	1.030	0.919	0.830
	(0.184)	(0.123)	(0.100)	(0.103)	(0.103)	(0.100)	(0.091)	(0.108)	(0.135)
Other variables included in regressions									
Constant	yes	yes	yes	yes	yes	yes	yes	yes	yes
Control variables	yes	yes	yes	yes	yes	yes	yes	yes	yes
Further education	yes	yes	yes	yes	yes	yes	yes	yes	yes
Upward mobility	yes	yes	yes	yes	yes	yes	yes	yes	yes
Downward mobility	yes	yes	yes	yes	yes	yes	yes	yes	yes

Koenker and Bassett's (1978) quantile regressions are estimated in a system at all percentiles of the adult wage distribution and separately for each graduation period; standard errors based on a simultaneous design–matrix bootstrap with 500 replications in parentheses; the adult wage is measured as the log of the real daily gross wage in the eighth year of potential experience; youth employment is measured as the total number of days in covered full-time employment between the start of the second and the end of the fifth year of potential experience; [$\cdot 10^4$] indicates that the corresponding coefficient estimates were multiplied by 10,000; for variable definitions, see Section 4.2 and Section 6.1.

veal that ex-post high wage earners realize different returns to stable employment in youth than workers with a generally low earning potential: The returns to early-career employment stability decrease across the adult wage distribution, irrespective of the graduation period under consideration. This pattern is in line with Buchinsky (1994), for instance, who



(a) All workers



(b) Full-time workers

Figure 4: Regressions of Log Real Daily Adult Wage (Quantile Regressions)

Notes: The figure plots returns to early-career employment stability at conditional percentiles of adult wage; Koenker and Bassett's (1978) quantile regressions are estimated in a system of all percentiles of the adult wage distribution and separately for each graduation period; shaded areas denote 95% robust confidence intervals, based on a simultaneous design–matrix bootstrap with 500 replications; the adult wage is measured as the log of the real daily gross wage in the eighth year of potential experience; youth employment is measured as the total number of days in covered full-time employment between the start of the second and the end of the fifth year of potential experience; the augmented set of control variables is included; for variable definitions, see Section 4.2 and Section 6.1.

documents decreasing returns to experience across the wage distribution for new entrants in the U.S.

The degree of heterogeneity in the effects remained quite stable during the 1980s. During the 1990s, however, the returns have increased, more so at the bottom than at the top. Graduates from the late 1980s receive a return of almost 10 percent at an annual rate when evaluated at the first decile, and of 2 percent when evaluated at the ninth decile. The annual rate of return to early-career employment stability for graduates from the late 1990s, in contrast, is about 21 percent at the first and 4 percent at the ninth decile. While the annual rate of return at the first decile was about 8 percentage points greater than at the ninth decile during the late 1980s, this difference was more than two times greater during the late 1990s.[15]

The pattern of decreasing returns to stability across the wage distribution within cohorts, and asymmetrically increasing returns between cohorts, is not specific to the case of conditional quantiles. This is shown in Appendix 6.4, which reproduces Figure 4 (a) not only using unconditional quantile regression but also applying quantile instrumental variable regression. Additionally, the linearity assumption is relaxed by including youth employment squared in the quantile regressions of Equation (6). However, linearity proves to provide a sufficiently close approximation for modeling the wage functions and is therefore maintained in the remainder of this paper.

Furthermore, Farber (1999) demonstrates that employment interruption is often followed by transitional episodes of part-time work in the U.S. In the current sample of German apprenticeship graduates, the probability of working part time in experience year eight increases continuously from 2.3 percent for cohorts from the late 1970s, to 4.1 percent for cohorts from the late 1980s, up to 13.6 percent for cohorts from the late 1990s [Table 9 in the appendix]. If a certain amount of on-the-job experience in the past facilitates access to full-time jobs, part of the returns to early-career employment stability within cohorts, and of the reported increase of the returns between cohorts, might be explained by the growing incidence of part-time work, particularly at the bottom of the wage distribution.

To test this hypothesis, Panel (b) of Figure 4 and of Table 4, respectively, reproduce the conditional quantile regressions of wages after eight years of potential experience, but for the sample of full-time workers. Remarkably, the returns to stability among full-time workers still decrease across the adult wage distribution within each graduation period, and increase asymmetrically between cohorts. Ruling out potential sample selection bias,

[15] To the extent that high wage earners receive higher returns to human capital accumulation, decreasing returns to on-the-job experience across the adult wage distribution seem to be incompatible with human capital theory. The revealed pattern appears more consistent with signalling [cf. Spence's (1973) signaling model]. For instance, if the relative demand for non-routine cognitive tasks increases, high-skill workers might be more able to offset adverse consequences of unstable employment histories. In contrast, if labor market competition among low-skill workers intensifies, prospective employers are probably more selective regarding applicants of lower quality with gaps in their resume. Given that increasing labor market intermediation has simplified screening, see Autor (2009) among others, a stable employment history might act as an increasingly important signal during the hiring process, particularly among workers supplying skills which are either frequently offered or rarely requested. This presumption is also in line with recent findings by Kroft, Lange and Notowidigdo (2013), who conclude that prospective employers use the employment history of unemployed job applicants as a signal of their productivity.

for graduates from the late 1980s, working part time explains roughly 42 (20) [18] percent of the annual rate of return at the first (fifth) [ninth] decile of wages. These numbers increase to 52 (36) [22] percent for graduates from the late 1990s. Furthermore, working part time explains about 32 (34) [9] percent of the increase in the annual rate at the first (fifth) [ninth] decile of wages between the late 1980s and the late 1990s. Among graduates from the late 1990s, however, the annual rate of return to early-career employment stability at the first (fifth) [ninth] decile of full-time adult wages is roughly 10 (5) [3] percent. These effects are still economically important.

4.2.3 Heterogeneity in Returns within Cohorts

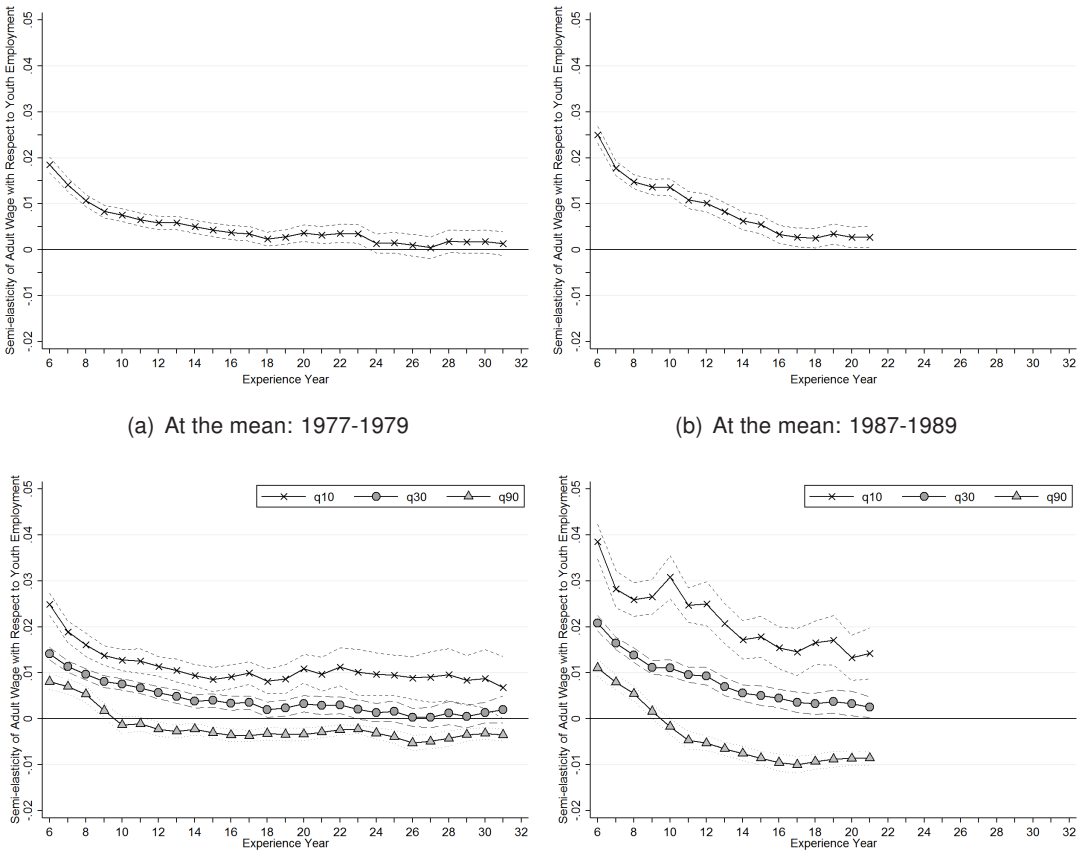
Until now, it is solely the returns to stable employment in youth in terms of wages after eight years since labor market entry which have been evaluated. But how do the returns evolve over the career cycle within a group of apprentices graduating under similar economic conditions but at different points in time? This question can be addressed by estimating Model (6) – jointly for part-time and full-time workers – after $a = 6, 7, ..., 31$ years of potential experience separately for cohorts from the late 1970s and late 1980s. The aggregate unemployment rate in the year of the wage observation is the only control variable that is altered with the experience year. Figure 5 depicts the estimated semi-elasticities of adult wage with respect to early-career employment stability at the mean and selected deciles of the (conditional) adult wage distribution.

The average return in both periods fades to zero as the career proceeds. The same is the case for the effects on the third decile, while effects on the ninth decile even turn significantly negative after about ten years.[16] The positive returns at the first decile, in contrast, remain economically and statistically significant over the part of the career cycle observed. Generally, the returns consistently decrease across the wage distribution in each year, and became more dispersed during the 1980s.

4.2.4 Employment Stability versus Further Education

Besides returns to early-career employment stability, there are also returns to further education during youth. These are documented in Figure 6 in Appendix 6.2, which reproduces Figure 5 but for further educational achievement instead of youth employment. One way of contrasting returns to stability with returns to further education is to compare the semi-elasticities of adult wage with respect to both the number of days worked full time in youth, d_y, and the completion of secondary or tertiary education by the end of the seventh year of potential experience, indicated by the dummy variable l_y. Let $\tilde{\alpha}^{\theta}_{c,a}$ denote the estimated semi-elasticity of adult wage with regard to stability at percentile θ after a years in the labor

[16] There are two potential explanations for these negative returns at the top of the wage distribution: either stable employment in youth actually exhibits significant costs for ex-post high-wage earners in the long run, or the non-IV estimates are still subject to downward bias. In the latter case, non-IV estimates of the returns to early-career employment stability presented in this paper would have to be interpreted as lower bounds.



(a) At the mean: 1977-1979

(b) At the mean: 1987-1989

(c) At selected deciles: 1977-1979

(d) At selected deciles: 1987-1989

Figure 5: Regressions of Log Real Daily Adult Wage by Year of Potential Experience

Notes: The figure plots semi-elasticities of adult wage with respect to early-career employment stability at the mean (first row) and selected deciles (second row) of the wage distribution in a given experience year by graduation period; dashed lines indicate 95% robust confidence intervals; Koenker and Bassett's (1978) quantile regressions are estimated in a system of all deciles of the adult wage distribution in a given experience year; in the case of conditional quantile regressions, robust standard errors are calculated with a simultaneous design-–matrix bootstrap with 200 replications; the adult wage is measured as the log of the real daily gross wage in a given year of potential experience; youth employment is measured as the total number of days in covered full-time employment between the start of the second and the end of the fifth year of potential experience; the augmented set of control variables is included; for variable definitions, see Section 4.2 and Section 6.1.

market for labor market entry cohort c. It holds that

$$\tilde{\alpha}^{\theta}_{c,a} = [exp(\hat{\alpha}^{\theta}_{c,a}\Delta d_{c,y}) - 1]100, \tag{7}$$

where $\hat{\alpha}^{\theta}_{c,a}$ is the quantile regression coefficient estimate of youth employment at the θ percentile. Accordingly, the semi-elasticity with respect to further educational achievement is given by

$$\tilde{\delta}^{\theta}_{c,a} = [exp(\hat{\delta}^{\theta}_{c,a}\Delta l_{c,y}) - 1]100. \tag{8}$$

Completing further training switches the dummy variable from zero to one in Equation (8). Then, by setting $\tilde{\alpha}^{\theta}_{c,a}$ equal to $\tilde{\delta}^{\theta}_{c,a}$ and solving for $\Delta d_{c,y}$,

$$\Delta\hat{d}^{\theta}_{c,a,y} = \hat{\delta}^{\theta}_{c,a}/\hat{\alpha}^{\theta}_{c,a} \tag{9}$$

provides an estimate for the number of days that have to be spent working full time during the early career in order to generate the same returns as further educational achievement, evaluated after a years of potential experience and at the θ-percentile of adult wage.

$\Delta\hat{d}^{\theta}_{c,a,y}$ is presented together with the underlying coefficient estimates in Table 5 for experience years 8 to 19 of graduates from the late 1970s and late 1980s. The focus is on the first and third deciles. After eight years of potential experience and evaluated at the first decile, $\Delta\hat{d}^{0.1}_{77/79,8,y}$ equals 1.3 years for apprentices graduating between 1977 and 1979. This number suggests that 1.3 years of working full time during youth are equivalent to completing a secondary or tertiary education in terms of wage returns after eight years in the labor market for graduates from the late 1970s who are located at the bottom of the wage distribution. When evaluated at the third decile, the corresponding period increases to about 3.7 years. This difference emerges because the returns to early employment stability decrease over the wage distribution in the eighth year of potential experience, while the corresponding returns to further education increase, see Table 5. The corresponding periods after 8 experience years for the cohorts from 1987-1989 are 52 days at the first decile and 1.7 years at the third decile, reflecting the rise of the returns to stability during the 1980s.

In the long run, however, Figure 5 shows that the returns to early-career employment stability decrease continuously over the career cycle across the wage distribution within cohorts. Positive returns to stability only persist at the bottom. The returns to further education, in contrast, increase across the wage distribution in the early years. After about ten to twelve years in the labor market, the return to further education at the top of the wage distribution starts to decrease as the career proceeds.[17] Returns below the third decile, in contrast, keep growing at a decreasing rate over the observable part of the career cycle. Since initially low returns to further education catch up with initially high returns to employment stability at the bottom of wages, $\Delta\hat{d}^{0.1}_{77/79,a,y}$ exceeds four years after $a = 15$ years of potential experience, and $\Delta\hat{d}^{0.1}_{87/89,a,y}$ exceeds fours years after $a = 19$ years. $\Delta\hat{d}^{0.3}_{77/79,a,y}$ ($\Delta\hat{d}^{0.3}_{87/89,a,y}$) already exceeds four years after $a = 9(12)$ experience years. These patterns

[17] These estimates of the returns to further education must not be confused with estimates of the returns to education itself, which are frequently found to increase across the wage distribution [see Buchinsky (1994) for the U.S., Fersterer and Winter-Ebmer (2003) for Austria, and Fitzenberger and Kurz (2003) for Germany].

Table 5: Regressions of Log Real Daily Adult Wage by Year of Graduation and Year of Potential Experience (Quantile Regressions)

	(1)	(2)	(3)	(4)	(5)	(6)
Cohorts	1977-1979					
Decile	1			3		
Exp. year a	Youth empl. $[\cdot 10^4]$ *[a]*	Further education *[b]*	Number of days equalizing returns $[b]/([a] \cdot 10^{-4})$	Youth empl. $[\cdot 10^4]$ *[a]*	Further education *[b]*	Number of days equalizing returns $[b]/([a] \cdot 10^{-4})$
8	1.608	0.078	486	0.964	0.131	1,361
9	1.375	0.113	825	0.808	0.161	1,995
10	1.278	0.111	870	0.749	0.171	2,287
11	1.257	0.077	613	0.667	0.165	2,476
12	1.14	0.104	908	0.565	0.167	2,954
13	1.049	0.122	1,166	0.485	0.158	3,266
14	0.943	0.127	1,352	0.379	0.176	4,631
15	0.854	0.129	1,505	0.399	0.175	4,390
16	0.912	0.131	1,440	0.34	0.170	4,997
17	0.995	0.138	1,388	0.351	0.178	5,070
18	0.814	0.143	1,756	0.201	0.181	9,006
19	0.862	0.168	1,947	0.231	0.177	7,644
Cohorts	1987-1989					
Decile	1			3		
Exp. year a	Youth empl. $[\cdot 10^4]$ *[a]*	Further education *[b]*	Number of days equalizing returns $[b]/([a] \cdot 10^{-4})$	Youth empl. $[\cdot 10^4]$ *[a]*	Further education *[b]*	Number of days equalizing returns $[b]/([a] \cdot 10^{-4})$
8	2.592	0.014	53	1.382	0.087	626
9	2.656	0.049	185	1.119	0.093	830
10	3.08	0.096	310	1.104	0.111	1,003
11	2.474	0.083	336	0.957	0.130	1,362
12	2.501	0.108	432	0.933	0.157	1,679
13	2.072	0.140	676	0.701	0.143	2,046
14	1.716	0.200	1,168	0.563	0.170	3,018
15	1.784	0.209	1,170	0.502	0.166	3,306
16	1.543	0.219	1,418	0.443	0.173	3,910
17	1.455	0.200	1,375	0.354	0.162	4,566
18	1.653	0.216	1,305	0.324	0.180	5,568
19	1.708	0.257	1,502	0.374	0.193	5,169

Koenker and Bassett's (1978) quantile regressions are estimated in a system at all deciles of the distribution of wages in a given year of potential experience and separately for each graduation period; the adult wage is measured as the log of the real daily gross wage in year a of potential experience; youth employment is measured as the total number of days in covered full-time employment between the start of the second and the end of the fifth year of potential experience; $[\cdot 10^4]$ indicates that the corresponding coefficient estimates were multiplied by 10,000; further education is measured as a dummy variable indicating completion of secondary or tertiary education by the end of the seventh year of potential experience; the augmented set of control variables is included; for variable definitions, see Section 4.2 and Section 6.1.

provide suggestive evidence that stabilizing early employment patterns constitutes a more efficient measure to raise future wages than promoting further education in the short run and particularly for workers who exhibit a relatively low earning potential.

5 Conclusions

In this article, I contrasted early employment patterns of German males who graduated from the dual education system in West Germany between 1977 and 2001. The employment structure is increasingly polarizing among this group of workers in terms of the number of days worked during the crucial early stage of a career. In other words, while a decline in employment stability arises at the lower half of the youth employment distribution, employment durations above median length have even become slightly prolonged since the late 1970s. These shifts cannot be solely explained by changes in the selection into apprenticeship training over time.

I also related youth employment to adult wages and found a clear positive relationship. By exploiting macroeconomic shocks affecting otherwise identical workers at different points in their early career, I reached the conclusion that true state dependence is behind this relationship (at least to a large extent). Furthermore, decomposing adult wages between graduates from the late 1980s and late 1990s revealed a marked increase of the return to stable employment in youth during the 1990s. Declining employment stability is therefore increasingly undermining career prospects for those affected. Quantile regressions further showed that the returns to early-career employment stability decrease convexly over the wage distribution and that the rise of the average rate of return between cohorts is driven by substantial increases of the returns at the bottom of wages. In the mean, however, the findings indicated that wage effects of early employment stability are not highly persistent over the career cycle. Permanently positive returns occur only at the bottom of future wages.

In regard to policy intervention, the existence of state dependence implies that policies with the aim of stabilizing early-career employment paths – just like job offers via a Youth Guarantee, as recommended by the Council of the European Union (2013) – could in principle be successful in accelerating wage growth in future periods. Since the returns to stability are highest at the bottom of the wage distribution, such policies should be directed at workers with a low earning potential. Furthermore, a better integration of young low-skill workers into the labor market appears to be of growing importance given that the returns to early-career employment stability have increased substantially at the bottom of the wage distribution during the 1990s. For workers with a high earning potential, in contrast, the evidence suggests that promoting further education after an apprenticeship would be a more efficient way to support long-term wage growth than stabilizing early employment trajectories.

The findings of this study are also likely to be conceptually relevant for other developed economies for at least three reasons: First, changes in the wage structure toward higher inequality are observable in many industrialized countries. Although less frequently documented, declining employment stability, particularly among young workers, is not peculiar

to the present case of German apprenticeship graduates either. Second, despite clear differences in the institutional environment, the youth labor market in Germany exhibits remarkable similarities to that in the U.S., for example [see von Wachter and Bender (2006)]. Third, as Ryan (2001) emphasizes, an economic mechanism as fundamental as state dependence is unlikely to be only specific to one nation.

However, I would also like to stress that more research is needed concerning the interaction between early-career (un-)employment processes and adult labor market outcomes under changing economic conditions. Because of the econometric issues, the conclusions drawn above can never be definitive, and have to be complemented by evidence derived with the help of more structural approaches or even experiments.

In conclusion, many countries that are currently struggling with a high unemployment rate among their young workforce seek to facilitate the training-to-work transition, and to encourage early investments in human capital. In this context, the dual education system is often regarded as a promising benchmark for the implementation of more efficient school-to-work programs [see Harhoff and Kane (1997), or Neumark (2002)]. While a high degree of "resiliency in the face of technological change and other labor market developments" Harhoff and Kane (1997: p. 172) was considered a seminal feature of Germany's dual education system until the late 1980s, this no longer seems to be the case today. Hence, the implementation of similar systems in itself will probably not suffice to tackle the youth (un-)employment problem.

It remains to be seen to what extent demographic change or institutional reforms will counteract the divergence of wages, employment, and the cost of early-career employment instability in future decades.

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6 Appendix

6.1 Data Selection and Cleansing

After some basic data preparation, only individuals graduating from Germany's dual education system are selected from the SIAB. Training periods are defined as spells of apprenticeship training in one occupation with fewer than 32 days in between. About 14 percent of all individuals exhibit more than one training period according to this definition. More than two periods are observed in less than 3 percent of cases. In general, graduation is identified as the last day of the first training period. Individuals who are older than 26 years at the start of this period are excluded if they show only one apprenticeship. If there are multiple training periods, the end of the subsequent period is defined as the day of graduation if it lasts longer than the previous one, the previous period is shorter than one year, fewer than 92 days lie between the two periods, and the individual is under 27 at the beginning of the subsequent period. Because the focus is on apprentices without any previous labor market experience, only individuals who are older than 14 and younger than 31 at the time of graduation enter the sample. Furthermore, 9 percent of the remaining individuals hold an Abitur (school leaving qualification) or even a degree from tertiary education before the start of apprenticeship training. These are also excluded.

In less than 2 percent of the cases, the duration of training is longer than four years, which appears implausible. This can happen, for example, if employers have failed to update the status of those graduates who stay with their training firm. The actual end of training is identified by implausibly large wage increases between two presumed training spells. The 95^{th} percentile of the wage-growth distribution between spells within training periods lasting at least two but fewer than four years, which is equal to 50.1 percent, serves as threshold. Finally, all individuals with a relevant training period shorter than one month or longer than four years are excluded, as are individuals without any post-graduation observations. Remarkably, of all individuals who are younger than thirty when their first spell is recorded in the SIAB, almost 47 percent can be identified as graduates from the dual education system in this way.

Among the remaining apprentices, all women are excluded because of their comparatively weak attachment to the labor market. Furthermore, only individuals who are registered as German citizens at some point in time are selected, and only graduates from establishments located in West Germany are considered, where Berlin is assigned to East Germany. Since some wage observations appear unreasonably small or large, the entire employment histories of the individuals with the 1 percent highest and lowest adult wages in the full sample are dropped.

The control variables are usually extracted from the graduation spell. These are:

- *Graduation age:* A polynomial of second order in age is used to control for within-year-of-birth trends in adult wages.
- *Local unemployment rate at graduation:* Oreopoulos, von Wachter and Heisz (2012) document persistent earning declines up to ten years later for college graduates,

induced by the level of unemployment in the district of initial residence at the time of graduation. This is why differences in initial labor market conditions are controlled for by county-specific unemployment rates prevailing in the training firm's local labor market at graduation. Locations, in turn, are defined by the administrative districts of Germany's Federal Employment Agency.

- *Adult unemployment rate:* In order to capture persistent patterns in aggregate labor market conditions, the average unemployment rate prevailing during the year of the wage observation is used as an additional control variable. See Section 3.2 for further details.

- *Delayed report:* Due to peculiarities of the reporting system, before 1991 a considerable proportion of employers report December 31st as the day of graduation. This poses a problem for the validity of the identification strategy outlined in Section 3.2 if these "delayed reports" occur systematically. In the majority of such cases, individuals stay with their training firm after graduation. If stayers are a positive selection, IV estimates would be biased. Therefore, a dummy variable indicating December 31st as the day of graduation is included. Although this problem is of minor relevance for individuals graduating after 1990, this dummy variable is included in the regressions for the younger cohorts as well.

- *Wage level of the training firm:* The wage level is captured by the median wage of all employees employed on June 30th of the calendar year of graduation. A high wage level might reflect bargaining power or productive training conditions. Therefore, as discussed in Section 3, omitting this variable might lead to upward-biased estimates of the returns to early-career employment stability.

- *Size of the training firm:* Firm size is measured by the number of employees employed on June 30th of the calendar year of graduation. Since larger firms pay higher wage premia, and presumably provide better career prospects, omitting this variable might lead to upward-biased estimates of the returns to early-career employment stability.

- *Occupation:* In all quantile regression models, the occupation in which the individual was trained is modeled by dummy variables for nine categories based on the classification by Blossfeld (1987). These are: agricultural occupations, unskilled manual occupations, skilled manual occupations, technicians and engineers, unskilled service occupations, skilled service occupations, semi-professions and professions, unskilled commercial occupations, skilled commercial occupations, and managers. The reference category is unskilled manual occupations.

- *Sector of the training firm:* In all quantile regression models, the industry in which the training firm operates is indicated by dummy variables for ten aggregated sectors: energy and mining, manufacturing, construction, trade, transport and communication, financial intermediation, other services, non-profits, and households and public administration. The manufacturing industry is chosen as the reference category. Eberle, Jacobebbinghaus, Ludsteck and Witter's (2011) time-consistent industry classification for the BHP is used.

- *Graduation cohort:* Dummy variables indicating the calendar year of graduation are included to control for wage effects specific to a cohort of labor market entrants, caused by differences in size or composition, for instance. Furthermore, they control for longer-term trends, such as those related to the economic cycle or the quality of training.

Mean, standard deviation, minimum, and maximum of the key and the control variables are presented in Table 6.

Table 6: Summary Statistics

Variable	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
	1977-1979 (N = 12,657)				1987-1989 (N = 12,024)				1999-2001 (N = 8,030)			
Adult wage	4.29	0.263	2.50	4.93	4.37	0.305	2.52	4.98	4.22	0.435	2.50	4.99
Youth employment	981	403	0	1,461	1,018	431	0	1,461	882	524	0	1,461
Further education	0.048		0	1	0.068		0	1	0.102		0	1
Change of employer during youth [number of switches]												
Upward [1]	0.312		0	1	0.312		0	1	0.316		0	1
Upward [2]	0.096		0	1	0.095		0	1	0.118		0	1
Upward [3 or more]	0.037		0	1	0.043		0	1	0.048		0	1
Downward [1]	0.257		0	1	0.265		0	1	0.309		0	1
Downward [2]	0.080		0	1	0.080		0	1	0.121		0	1
Downward [3 or more]	0.036		0	1	0.039		0	1	0.051		0	1
Stable [1]	0.042		0	1	0.039		0	1	0.040		0	1
Stable [2]	0.002		0	1	0.002		0	1	0.003		0	1
Stable [3 or more]	0.000		0	1	0		0	0	0.000		0	1
No change	0.406		0	1	0.396		0	1	0.334		0	1
Graduation age	18.55	1.73	15	29	19.44	1.63	15	29	20.18	1.83	15	30
District UR	3.89	1.43	0.9	8.2	8.90	3.51	2.6	17.4	8.47	2.71	2.6	16.7
Adult UR	7.20	0.158	6.99	7.40	12.13	0.542	11.48	12.90	13.23	0.752	12.42	14.79
Training firm wage	4.17	0.283	2.06	4.81	4.30	0.285	1.78	4.96	4.40	0.293	0.733	5.05
Training firm size	884	3,910	1	53,166	950	4,529	1	62,825	596	3,164	1	48,639
Delayed report	0.686		0	1	0.547		0	1	0.095		0	1
Training occupation												
Agricultural	0.018		0	1	0.019		0	1	0.020		0	1
Unskilled manual	0.070		0	1	0.097		0	1	0.094		0	1
Skilled manual	0.671		0	1	0.682		0	1	0.627		0	1
Technical	0.038		0	1	0.023		0	1	0.032		0	1
Unskilled service	0.016		0	1	0.019		0	1	0.025		0	1
Skilled service	0.013		0	1	0.012		0	1	0.013		0	1
(Semi)Professions	0.015		0	1	0.010		0	1	0.016		0	1
Unskilled commerc.	0.026		0	1	0.028		0	1	0.025		0	1
Skilled commerc.	0.133		0	1	0.111		0	1	0.148		0	1
Training firm industry												
Agriculture	0.014		0	1	0.015		0	1	0.014		0	1
Energy/Mining	0.025		0	1	0.030		0	1	0.017		0	1
Manufacturing	0.510		0	1	0.506		0	1	0.448		0	1
Construction	0.169		0	1	0.155		0	1	0.197		0	1
Trade	0.133		0	1	0.113		0	1	0.121		0	1
Transport/Communic.	0.032		0	1	0.045		0	1	0.035		0	1
Financial intermed.	0.024		0	1	0.019		0	1	0.014		0	1
Other services	0.071		0	1	0.081		0	1	0.113		0	1
Non-profits	0.003		0	1	0.009		0	1	0.011		0	1
Public admin.	0.018		0	1	0.027		0	1	0.029		0	1
Year of graduation												
1977|1987|1999	0.344		0	1	0.368		0	1	0.330		0	1
1978|1988|2000	0.324		0	1	0.333		0	1	0.333		0	1
1979|1989|2001	0.332		0	1	0.298		0	1	0.337		0	1
Instrumental variable												
$UR_{e,y}$	5.21	1.00	3.21	6.50	7.96	1.06	6.58	9.73	10.44	0.975	9.25	12.33

Establishments located in the manufacturing industry train the most individuals, followed by construction and trade. About two-thirds of all apprentices are trained in skilled manual occupations. Reflecting demographical change, the cohort size decreases over time.

The average graduation age of graduates from the late 1970s, late 1980s, and late 1990s increases continuously. This is, on the one hand, because individuals from younger co-

horts begin their training later, and, on the other hand, because training periods are getting longer. The relative frequencies of the occupations trained, however, are quite stable over time. Some slight shifts are in favor of service and at the expense of manual occupations. The structure of the establishments providing training, in turn, shows more pronounced changes: On the one hand, average firm size declines. On the other hand, training firms are more frequently located in the service industry, and less so in the manufacturing industry. Quantitatively, however, manufacturing is still the most important sector by far.

In regard to the key regressor, the average duration of full-time employment for young people goes up by less than one month from the late 1970s to the late 1980s, and drops by more than four months from the late 1980s to the late 1990s. The variability in employment durations during youth increases continuously and substantially across the three graduation periods considered here. At the same time, adult wage inequality also increases.

6.2 Supplementary Tables and Figures

Table 7: Career Dynamics by Year of Potential Experience

Exp. year	Mean of log real daily gross wage	Mean of days employed full time	Upward mobility (%)	Downward mobility (%)
1	3.784	204.2	20.8	18.9
2	3.937	183.8	15.4	13.8
3	4.026	201.0	14.6	12.8
4	4.099	215.7	13.6	11.7
5	4.161	225.8	12.5	10.9
6	4.216	235.5	11.7	10.4
7	4.271	244.3	11.1	9.6
8	4.323	251.0	10.3	9.0
9	4.354	255.4	9.7	8.6
10	4.387	257.8	9.1	8.0
11	4.415	259.1	8.4	7.8
12	4.439	259.0	8.1	7.3
13	4.462	258.1	7.6	6.9
14	4.480	256.8	7.3	6.8
15	4.496	255.2	6.8	6.4
16	4.509	253.0	6.2	6.2
17	4.524	250.6	6.0	5.7
18	4.533	248.3	5.9	5.5
19	4.540	246.2	5.4	5.4
20	4.542	244.4	5.4	5.2
21	4.549	242.3	5.3	4.9
22	4.557	240.1	4.8	4.7
23	4.560	237.9	4.6	4.6
24	4.563	235.1	4.4	4.4
25	4.564	232.5	4.1	4.3
26	4.567	229.3	3.8	4.1
27	4.564	227.0	3.7	3.8
28	4.557	224.1	3.7	3.6
29	4.556	221.7	3.5	3.3
30	4.549	219.5	3.4	3.3
31	4.547	217.1	2.9	3.0
32	4.544	212.4	2.7	2.9
33	4.542	211.2	1.9	2.2

Notes: The table plots the means of log real daily gross wage and of the total number of days in covered full-time employment as well as the probabilities of experiencing at least one change of employer accompanied by an increase in employer quality, and experiencing at least one change of employer accompanied by a decrease in employer quality for all apprenticeship graduates pooled between 1977 and 2009 against the year of potential experience.

Table 8: Adult Wage and Youth Employment Distributions by Graduation Period

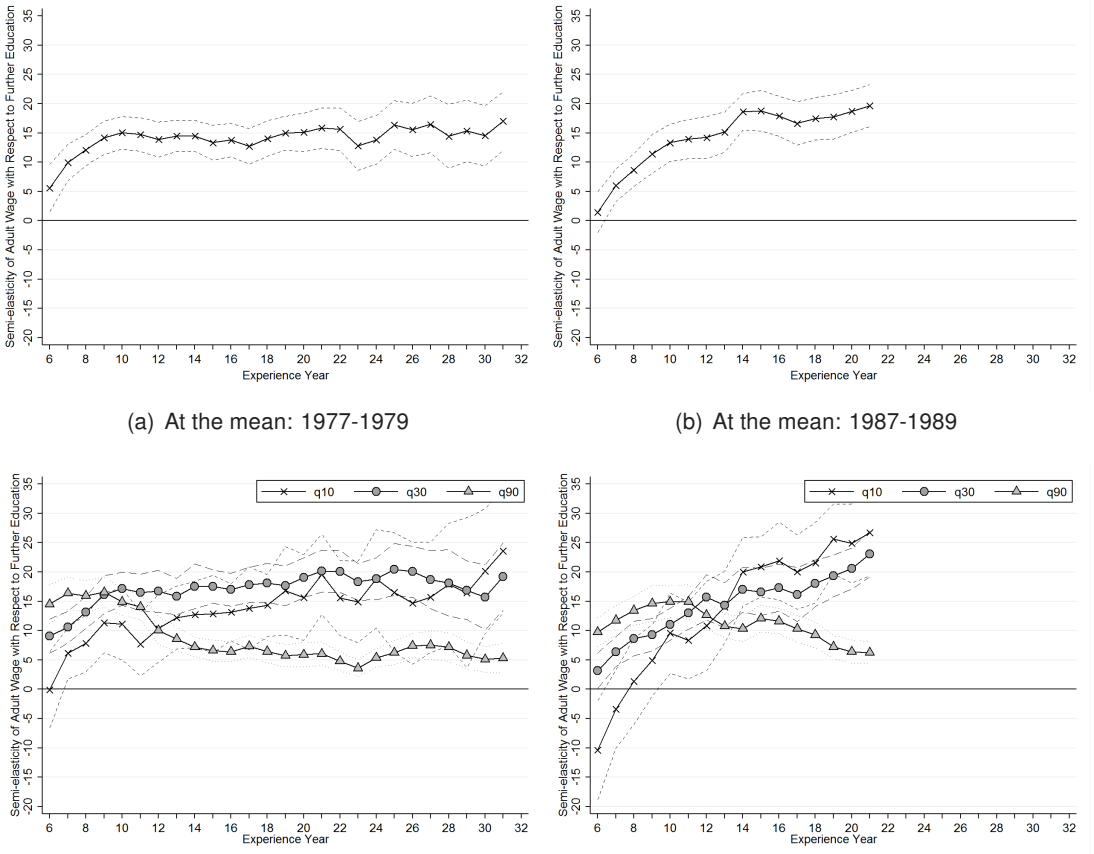
					Adult wage (exp. year 8)					
Period/percentile	*5*	*10*	*15*	*20*	*25*	*30*	*35*	*40*	*45*	*50*
1977-1979	3.89	4.02	4.08	4.13	4.17	4.20	4.23	4.26	4.28	4.31
1987-1989	3.86	4.07	4.15	4.21	4.25	4.29	4.32	4.35	4.38	4.41
1999-2001	3.38	3.67	3.84	3.96	4.03	4.09	4.15	4.20	4.25	4.29
Period/percentile	*55*	*60*	*65*	*70*	*75*	*80*	*85*	*90*	*95*	*max*
1977-1979	4.33	4.36	4.39	4.42	4.45	4.48	4.53	4.59	4.69	4.93
1987-1989	4.43	4.46	4.49	4.52	4.55	4.59	4.63	4.70	4.78	4.98
1999-2001	4.32	4.37	4.41	4.45	4.51	4.56	4.63	4.71	4.81	4.99
					Youth employment (exp. years 2 to 5)					
Period/percentile	*5*	*10*	*15*	*20*	*25*	*30*	*35*	*40*	*45*	*50*
1977-1979	125.9	341.6	521	660	748	856	937.3	992	1,005	1,006
1987-1989	92	265.5	468.5	655	794	919.5	1,005	1,059	1,095	1,096
1999-2001	0	23	123	252	396	546	688	823	944	1,059.50
Period/percentile	*55*	*60*	*65*	*70*	*75*	*80*	*85*	*90*	*95*	*max*
1977-1979	1,064	1,096	1,180.70	1,262	1,329	1,408	1,460	1,461	1,461	1,461
1987-1989	1,125	1,188	1,277	1,354	1,417	1,459	1,461	1,461	1,461	1,461
1999-2001	1,132	1,186.60	1,240	1,308	1,381	1,442	1,461	1,461	1,461	1,461

Notes: The table plots quantiles of the distributions of adult wage and early-career employment stability; the adult wage is measured as the log of the real daily gross wage in the eighth year of potential experience; youth employment is measured as the total number of days in covered full-time employment between the start of the second and the end of the fifth year of potential experience; the cohorts are pooled over the respective graduation period.

Table 9: Career Dynamics by Graduation Period (in %)

Year of graduation	Part-time exp. year 8	Further educ.	Upward mobility exp. years 2 to 5	Downward mobility
1977-1979	2.3	6.2	45.6	37.8
1987-1989	4.1	7.6	46.1	40.6
1999-2001	13.6	10.5	47.4	48.5

Notes: The table plots the probabilities of working part time in experience year eight and successfully participating in further education, experiencing at least one change of employer accompanied by an increase in employer quality, and experiencing at least one change of employer accompanied by a decrease in employer quality during experience years two to five against year of graduation.



(a) At the mean: 1977-1979

(b) At the mean: 1987-1989

(c) At selected deciles: 1977-1979

(d) At selected deciles: 1987-1989

Figure 6: Returns to Further Education by Year of Potential Experience

Notes: The figure plots semi-elasticities of adult wage with respect to further education during youth at the mean (first row) and selected deciles (second row) of the wage distribution in a given experience year by graduation period; dashed lines indicate 95% robust confidence intervals; Koenker and Bassett's (1978) quantile regressions are estimated in a system of all deciles of the adult wage distribution in a given experience year; in the case of conditional quantile regressions, robust standard errors are calculated with a simultaneous design-–matrix bootstrap with 200 replications; the adult wage is measured as the log of the real daily gross wage in a given year of potential experience; the augmented set of control variables is included; for variable definitions, see Section 4.2 and Section 6.1.

6.3 Returns to Stability – Sensitivity Checks (Augmented OLS Regressions)

The finding of significant returns to stable employment early in professional life does not depend on the definitions of employment or wages respectively. Table 10 presents OLS estimates of Model (6), where the early career is still defined over experience years two to five, and wages are evaluated after eight years in the labor market. Maintaining the

Table 10: Regressions of Log Real Daily Adult Wage by Year of Graduation (Augmented OLS Regressions – Various Wage and Employment Measures)

	(1)	(2)	(3)	(4)	(5)
	Baseline wage measure			Baseline employment measure	
	Job stability	Occupational stability	Employment continuity	Wage, main job	Wage, imputed
Cohorts	1977-1979 (N = 12,657)				
Youth Employment [$\cdot 10^4$]	0.833···	0.943···	0.893···	1.076···	1.104···
	(0.066)	(0.066)	(0.058)	(0.071)	(0.068)
Cohorts	1987-1989 (N = 12,024)				
Youth Employment [$\cdot 10^4$]	1.167···	1.292···	1.248···	1.465···	1.477···
	(0.077)	(0.078)	(0.066)	(0.081)	(0.078)
Cohorts	1999-2001 (N = 8,030)				
Youth Employment [$\cdot 10^4$]	2.549···	2.548···	2.483···	2.721···	2.683···
	(0.114)	(0.107)	(0.099)	(0.113)	(0.105)
Other variables included in regressions					
Constant	yes	yes	yes	yes	yes
Control Variables	yes	yes	yes	yes	yes
Further education	yes	yes	yes	yes	yes
Employer changes	yes	yes	yes	yes	yes

Notes: Robust standard errors in parentheses; *, (**), [***] indicate significance at the 10, (5), [1] percent level;
in (1) the baseline employment measure is replaced by job stability, the duration in days of the longest full-time job;
in (2) the baseline employment measure is replaced by occupational stability, the total number of days spent employed full time in the occupation with the longest overall duration;
in (3) the baseline employment measure is replaced by employment continuity, the duration in days of the longest period of continuous full-time employment;
in (4) the baseline wage measure is replaced by the daily wage from the longest job with the highest wage;
in (5) the baseline wage measure is corrected for top-coding by imputing latent values above the censoring point;
$[\cdot 10^4]$ indicates that the corresponding coefficient estimates were multiplied by 10,000;
for variable definitions, see Section 4.2 and Section 6.1.

baseline wage measure, early-career employment stability is replaced with i) job stability, the duration in days of the longest full-time job, ii) occupational stability, the total number of days spent employed full time in the occupation with the longest overall duration accumulated by an individual during his youth, which takes into account Gathmann and Schönberg's (2010) finding that human capital is specific to occupation or rather task, and

iii) employment continuity, the duration in days of the longest period of continuous full-time employment with any employer, where two employment spells are connected if fewer than three months are between them. Furthermore, maintaining the baseline employment measure, iv) only the wage from the longest job with the highest wage is considered, or v) top-coded wages are replaced with wages imputed with the help of tobit regression procedures in the SIAB's full sample that are similar to those used in Card, Heining and Kline (2013).[18] However, none of these estimates of the return to stability substantially deviates from the baseline specification.

This is also the case if, returning to the baseline wage and employment measures, the early career is defined over the first five years of potential experience, or if adulthood is defined over experience years eight and nine, or if the minimum duration of training is restricted to one or two years respectively [Table 11]. The latter sample restrictions again address the potential problem of selective drop-outs.

6.4 Returns to Stability – Sensitivity Checks (Quantile Regressions)

Figure 7 reports the effects of early-career employment stability on the quantiles of the unconditional adult wage distribution. To this end, Firpo, Fortin and Lemieux's (2009) recentered influence function regressions of Model (6) are estimated. Apparently, findings for conditional quantile functions translate almost one to one to unconditional quantile functions.

Furthermore, Figure 8 extends the IV analysis to the estimation of conditional quantile functions. The conditional θ-quantile of adult wage, $Q^{\theta}(w_{c,8}|d_{c,y}, \mathbf{x}_{c,g})$, is estimated for each percentile with quantile instrumental variable regressions (IVQR). The IVQR procedure applied is introduced by Chernozhukov and Hansen (2005) and allows the instrumentation of a continuous endogenous regressor in a quantile regression framework. Under the conditions stated therein, a quantile treatment effect is identified without it being necessary to rely on functional form assumptions. The procedure is implemented on the basis of the Matlab command *inv_qr*. Inference is based on Chernozhukov and Hansen (2008). Again, the instrument is the aggregate unemployment rate averaged over youth ($UR_{e,y}$). The regressions are carried out separately for graduates from the periods 1977-1979, 1987-1989, and 1999-2001. The estimates are depicted in Figure 8. Unfortunately, estimates for the six oldest cohorts are quite imprecise. However, the basic insights from the previous analyzes remain unchanged: The returns to early-career employment stability decrease across the adult wage distribution and increase between cohorts, more so in the lower tail than in the upper tail.

Finally, the relationship between youth employment and adult wage may not be linear. The linearity assumption can be relaxed by adding youth employment squared to specifications (1) and (6) respectively. Figure 9 presents the corresponding wage–employment profiles implied by these models, estimated with conditional quantile regressions separately

[18] In experience year eight, less than 4 percent of wage observations are top-coded in my sample of apprentices.

Table 11: Regressions of Log Real Daily Adult Wage by Year of Graduation (Augmented OLS Regressions – Robustness Regressions)

	(1)	(2)	(3)	(4)
Specification	Employment stability exp. years one to five	Wages averaged over exp. years eight to nine	Length of training at least one year	Length of training at least two years
Cohorts	1977-1979			
Youth Employment [$\cdot 10^4$]	0.946···	1.018···	0.950···	0.776···
	(0.058)	(0.065)	(0.071)	(0.077)
Observations	12,657	13,199	11,272	8,812
Cohorts	1987-1989			
Youth Employment [$\cdot 10^4$]	1.265···	1.525···	1.423···	1.452···
	(0.067)	(0.080)	(0.082)	(0.094)
Observations	12,024	12,659	11,245	9,207
Cohorts	1999-2001			
Youth Employment [$\cdot 10^4$]	2.328···	2.713···	2.461···	2.366···
	(0.090)	(0.106)	(0.113)	(0.129)
Observations	8,030	8,439	7,148	5,959
Other variables included in regressions				
Constant	yes	yes	yes	yes
Control variables	yes	yes	yes	yes
Further education	yes	yes	yes	yes
Employer changes	yes	yes	yes	yes

Notes: Robust standard errors in parentheses; *, (**), [***] indicate significance at the 10, (5), [1] percent level;
in (1) employment stability is measured during the first five years since graduation;
in (2) wages are averaged over experience years eight and nine;
in (3) individuals with an initial training period of less than one year are excluded;
in (4) individuals with an initial training period of less than two years are excluded;
$[\cdot 10^4]$ indicates that the corresponding coefficient estimates were multiplied by 10,000;
for variable definitions, see Section 4.2 and Section 6.1.

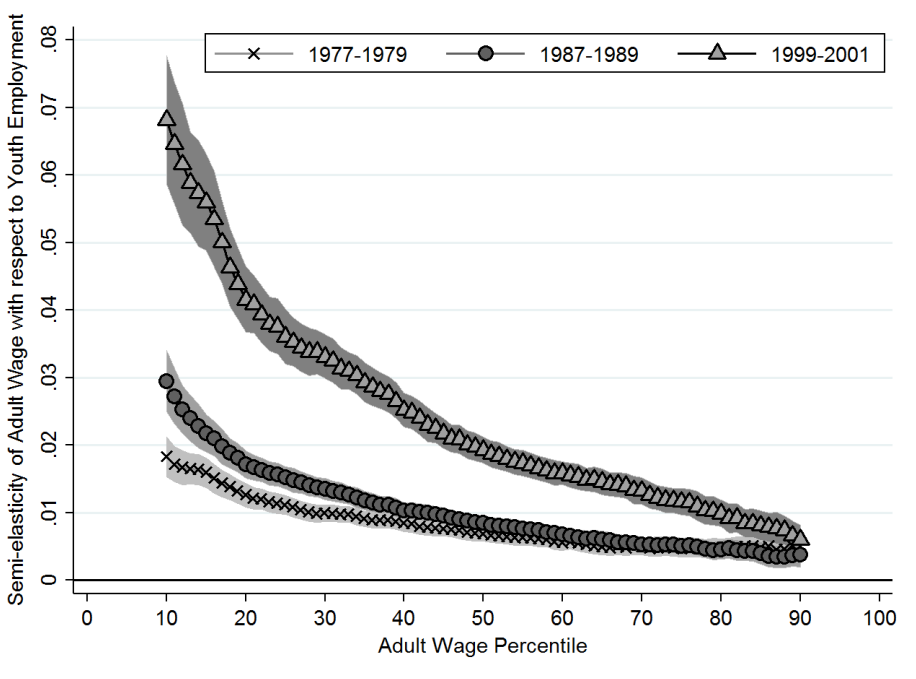


Figure 7: Regressions of Log Real Daily Adult Wage (Unconditional Quantile Regressions)

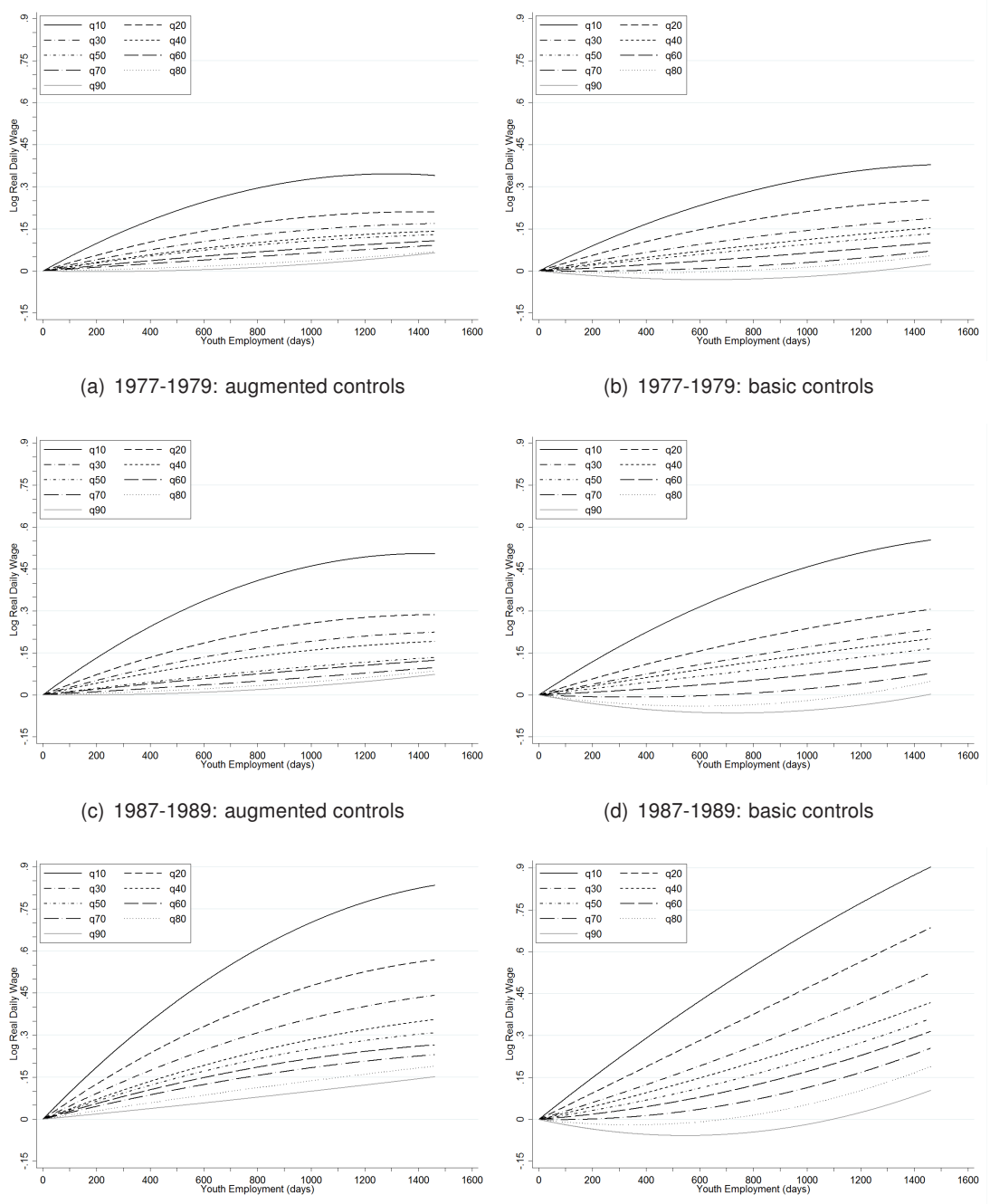
Notes: The figure plots returns to early-career employment stability at unconditional percentiles of adult wage estimated with Firpo, Fortin and Lemieux's (2009) recentered influence function regressions by graduation period; shaded areas denote 95% confidence intervals, bootstrapped with 500 replications; the adult wage is measured as the log of the real daily gross wage in the eighth year of potential experience; youth employment is measured as the total number of days in covered full-time employment between the start of the second and the end of the fifth year of potential experience; the augmented set of control variables is included; for variable definitions, see Section 4.2 and Section 6.1.

Figure 8: Regressions of Log Real Daily Adult Wage (Quantile Instrumental Variable Regressions)

Notes: The figure plots returns to early-career employment stability at conditional percentiles of adult wage estimated with quantile instrumental variable regressions by graduation period; triangles (squares) [circles] denote significance at the 1 (5) [10] percent level; analytical standard errors are based on Chernozhukov and Hansen (2008); the quantile instrumental variable procedure is implemented on the basis of the matlab command *inv_qr*; the lowess estimator with a bandwidth of 0.1 was used for smoothing; the adult wage is measured as the log of the real daily gross wage in the eighth year of potential experience; youth employment is measured as the total number of days in covered full-time employment between the start of the second and the end of the fifth year of potential experience; the basic control variables are included; the instrument is the aggregate unemployment rate averaged over the second to fifth experience year ($UR_{e,y}$); for variable definitions, see Section 3.2 and Section 6.1.

for the periods 1977-1979, 1987-1989, and 1999-2001. The slope of each line equals the (conditional) quantile partial effect of youth employment at a given decile of the adult wage distribution, and a given duration of youth employment. For the purposes of presentation, all other variables of the model are set to zero.

The picture of asymmetrically increasing returns between cohorts remains unchanged, irrespective of whether only the basic set of control variables is included or the augmented set. However, the estimated returns at the top of the wage distribution change in sign with the duration of total employment in youth when only the basic control variables are considered: While the returns are negative for short durations, they become positive for long durations. The estimated returns at the top in the model additionally controlling for employer mobility and further educational achievement, in turn, are always positive. This picture is consistent with positive returns to mobility counteracting the positive returns to stability, particularly in the upper tail of the wage distribution, cf. Neumark (2002). Furthermore, the linearity assumption seems to provide a sufficiently close approximation for modeling the wage functions.



(a) 1977-1979: augmented controls

(b) 1977-1979: basic controls

(c) 1987-1989: augmented controls

(d) 1987-1989: basic controls

(e) 1999-2001: augmented controls

(f) 1999-2001: basic controls

Figure 9: Wage–Employment Profiles by Graduation Period

Notes: The figure plots wage–employment profiles from conditional quantile regression estimates of the returns to early-career employment stability at the deciles of the adult wage distribution by graduation period; the profiles are calculated while setting all the other variables in the model to zero; the adult wage is measured as the log of the real daily gross wage in the eighth year of potential experience; youth employment is included as a polynomial of second order, and measured as the total number of days in covered full-time employment between the start of the second and the end of the fifth year of potential experience; for variable definitions, see Section 4.2 and Section 6.1.

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