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THE IMPACT OF CHANGING YOUTH EMPLOYMENT PATTERNS ON FUTURE WAGES

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This paper examines employment patterns on the labor market for youth and changing returns to early-career employment stability over the past four decades. German administrative matched employer-employee data allow to contrast the careers of German males who graduated from the Dual Education System in West Germany between the years 1977 and 2001. True state dependence is separated from unobserved heterogeneity by utilizing within-cohort variation in aggregate economic conditions prevailing at different stages of the early-career cycle as an instrument for stability. The results indicate decreasing stability of employment since the late 1980s, limited to the lower half of the employment distribution. Stable employment early in professional life, however, is found to have significant positive wage returns, particularly for low wage earners. These returns have substantially increased between the late 1970s and the late 1990s, again especially for low wage earners.

Keywords: Youth employment, Returns to employment stability, True state dependence, Quantile instrumental variable regression
JEL-Classification: C20, J21, J31.

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 youth. In April 2013, the Council of the European Union has recommended to establish 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 in youth 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 for wage determination, however, is crucial to efficiently promote the formation of long-lived and productive employer-employee matches.

To contribute to this discussion, this article explores whether employment during the first years on the labor market has become less stable for a sample of male German workers who graduated from the Dual Education System in West Germany between the years 1977 and 2001. In a next step, it investigates how stable employment patterns early in the professional career impact on the distribution of wages later in life, holding everything else constant. Comparing

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the estimated wage returns from different graduation periods provides insights into how the wage structure has changed within the system.

It is well established that the first years on the labor market are decisive for the professional development of an individual. However, the functioning of the early career as an adjustment process is of dual nature: On the one hand, there is pronounced job mobility compared to later years. This is often interpreted as an expression of job search resulting in exponential wage growth [cf. Bartel and Borjas (1981) or Topel and Ward (1992)]. On the other hand, stable employment during the early career is often considered to play an important role as well, for example when firms screen job applicants by means of their employment history [cf. Blanchard and Diamond (1994) or Atkinson (1996)]. At the same time, the relative weak attachment of young workers to the labor market poses risk, for instance leading to a lower degree of protection against dismissal for operational reasons, an event that is often accompanied by persistent wage loss [cf. Jacobson, LaLonde and Sullivan (1993), von Wachter and Bender (2006), or Schmieder, von Wachter and Bender (2010)]. There is also evidence that young workers' careers are particularly vulnerable to demand-side shocks and changing economic conditions [cf. Farber (1993), Blanchflower and Oswald (1994), or Smith (2012)]. Such disturbances in the early-career employment process might induce long-lasting wage differences among otherwise identical individuals. From a theoretical point of view, these differences are predominantly explained by skill depreciation during periods of joblessness [cf. Pissarides (1992) or Acemoglu (1995)] and adverse signalling [cf. Vishwanath (1989) or Gibbons and Katz (1991)].

However, there are good reasons to conjecture that ongoing changes of the economic environment have altered the nature of state dependence between early labor market experiences and adult labor market outcomes. For instance, skill-biased technological change towards the intensified use of non-routine cognitive tasks, as documented by Autor, Levy and Murnane (2003), accelerates the depreciation of human capital during joblessness if the underlying skills are more costly to appropriate and depreciate faster than those required to perform routine tasks. Besides, rising labor market intermediation, as discussed by Autor (2009), has reduced the costs of information available to both sides of the labor market.[1] From the employers' point of view, technological and institutional change, changes in the employment relationship, and intensified competition on the product market might have both simplified and increased the need for screening applicants during the hiring process. From the job seekers' perspective, growing transparency renders search more efficient and thereby contributes to the formation of pro-

[1] Autor (2009) outlines that Labor Market Intermediaries, like public employment offices, labor unions, centralized job matching markets, and providers of online job search or criminal records, regulate how workers are matched to firms. There is also evidence that employers make increasingly use of temporary work agencies as a screening device, cf. Houseman and Polivka (2000). Therefore, growing labor market intermediation provides a consistent explanation for the recent trend of rising assortativeness in the matching of workers to plants documented by Card, Heining and Kline (2013).

ductive matches. Interruptions of the employment process early in professional life might, in turn, increasingly damage career prospects, irrespective of an individual's true level of productivity. Consequently, the returns to early-career employment stability for two identical career trajectories starting at different points in time are likely to differ.

In general, analyses of the youth labor market require 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 Labour Market Biographies (SIAB) – complete this task. From this data, the sub-sample of male German workers who graduated from the Dual Education System in West Germany between the years 1977 and 2001 is selected. Contrasting the distributions of total full-time employment accumulated during the first years on the labor market reveals declining employment durations for cohorts graduating after the late 1980s, relative to older cohorts. However, these declines are limited to the lower half of the employment distribution, while durations above the median have even slightly prolonged. A lack of experience on the job in youth is shown to be generally costly in terms of lower wages in adulthood. Ordinary least squares (OLS) estimates of the average annual rate of return to early-career employment stability reveal an increase across cohorts, starting from about 2.9 percent in the late 1970s, rising to about 4.9 percent in the late 1980s, and arriving at about 10.2 percent in the late 1990s. Consistent with the hypothesizing above, these findings indicate increasing average costs of instable employment during the early career, particularly observable since the mid 1980s. What is more, the returns to stability continuously decline across the adult wage distribution, irrespective of the graduation period under consideration. This pattern becomes more dispersed across cohorts, revealing the rise of the average rate of return to be predominately driven by steep increases at the lower tail of the adult wage distribution.[2]

The results still hold when an instrumental variable (IV) strategy exploiting within-cohort variation in overall work experience induced by differences in aggregate economic conditions prevailing at different stages of the early-career cycle is applied. The instrument is constructed from aggregate unemployment rates on a *daily* basis, averaged over the individual's early career.[3] This variation

[2]The result of decreasing returns across the wage distribution and asymmetrically increasing returns across cohorts holds for conditional, unconditional, and instrumental variable quantile regression estimates. The former finding is consistent with decreasing returns to experience across the wage distribution for new entrants in the U.S., documented by Buchinsky (1994). In his sample, however, the effects at different wage-quantiles are converging rather than diverging during the 1980s.

[3]A collapse in the demand for labor as a result of an economic crisis serves as exogenous shock. There are three severe crises sufficiently covered by the data: the second oil-crisis around the early 1980s, the recession following the end of the post-reunification boom around the early 1990s, and the recession entailed by the burst of the internet bubble in 2002. Importantly, only the individuals entering the labor market in the three years *prior* to each recession are

is exogenous because the instrument varies only with the day of graduation, and the day of graduation is assumed exogenous in a model of adult wage determination. Furthermore, it constitutes relevant variation because an individual's employment is, as will be shown, less vulnerable to adverse economic conditions the more time has elapsed between graduation and the fall in labor demand. By contrast, the earlier an economic downturn emerges in the career the more time is available to offset initially bad job matches afterwards, which justifies the exclusion restriction.[4]

This paper contributes to the existing literature in several ways: First, it adds to the literature on changes in the employment relationship. Neumark (2000) summarizes evidence for workers on the U.S. labor market and concludes that, in the aggregate, 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 of this literature. 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 youth 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. For the sample of young apprentices studied here, only already comparatively short employment durations are declining for younger relative to older cohorts, while durations of medium length even slightly prolong. An appropriate measure of stability, besides of being time-consistent, should take such distributional changes into account. Differences in average job tenure, for instance, might only provide a limited view of the underlying development.

Second, the IV strategy involves estimating the wage and employment effects of experiencing a recession at an earlier versus a later point in the still young career, for different cohorts of graduates. These effects are of interest to the broader literature on interactions between career trajectories and early labor market conditions, like Oreopoulos, von Wachter and Heisz (2012) or Adda, Dustmann, Meghir and Robin (2013). One remarkable finding is that experiencing a recession earlier on reduces the mean of later wages considerably more for younger than for older cohorts, while the employment losses induced by each of the three recessions considered here are of similar magnitude. This shows that facing adverse aggregate economic conditions early in professional life has become increasingly costly in terms of future wage loss since the late 1970s.

Finally, this article contributes to the literature on state dependence between past labor market experiences and future labor market outcomes. Regarding

considered in the IV approach. Section 4.3.1 outlines this identification strategy in detail.

[4]Potential correlation of the instrument with unobserved match quality or with voluntary job mobility would violate the exclusion restriction. Consistent with Neumark (2002), the results suggest that mechanisms of this type would – if at all – bias IV estimates of the returns to employment stability towards zero. Section 6 discusses this issue and provides evidence.

the question whether young workers receive positive and long-lasting returns to stable employment patterns early in their careers, this literature derives no uniform conclusion: While Gardecki and Neumark (1998) find no significant wage returns to early job stability for young workers in the U.S., Neumark (2002) reports substantial returns. Drawing on his theoretical model and empirical results, Neumark (2002) concludes that estimates of the returns to stability from misspecified wage models tend to *understate* the true returns. He argues that this is because "although there are returns to search, there are also positive returns to early job stability" Neumark (2002, p. 463), and that both effects tend to offset each other. In the sample of German apprenticeship graduates studied here, there is plenty of evidence supporting this hypothesis. Relative to the absolute magnitude of the downward bias in simple OLS estimates, the magnitude of the upward bias appears to be far smaller. This finding suggests that simple OLS estimates of these types of "scarring" effects can be interpreted as lower bounds if the outcome is determined by a process involving simultaneous decisions on stability and mobility.[5] Further complementing existing studies, it is investigated 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 they develop over the professional career for a given cohort.

The following section describes the data set, defines variables, and characterizes the distributions of youth employment and of adult wages. Section 3 discusses methodological issues on the basis of a simple econometric model for the process of wage determination. Sections 4 and 5 present the regression results, which are interpreted in Section 6. Section 7 concludes.

2. DATA, MEASURES, AND DESCRIPTIVES

2.1. *Data*

The empirical analyses in this paper are based on the weakly anonymous version of the Sample of Integrated Labour Market Biographies (SIAB) provided by the Research Data Centre (FDZ) of the Federal Employment Agency (BA) at the Institute for Employment Research (IAB). This sample is based on process-generated data from different sources used by Germany's social security agencies to calculate social security contributions as well as unemployment benefits, which makes them highly reliable. For scientific purposes, data from all these sources are edited and merged in the Integrated Employment Biographies (IEB). The IEB contain comprehensive information on complete labor market biographies and socio-demographic characteristics depicted exact to the day. They provide the basis for many popular studies on German labor market issues, like von Wachter

[5]Provided that there is a certain degree of external validity, this finding is also in favor of the literature reporting significant scarring effects of youth unemployment, see Ryan (2001), Gregg (2001), or Schmillen and Umkehrer (2013) and the references therein.

and Bender (2006), Dustmann, Ludsteck and Schönberg (2009), or Card, Heining and Kline (2013). About 80 percent of the total German workforce is covered [cf. Oberschachtsiek, Scioch, Seysen and Heining (2009)]. The SIAB, finally, is a two percent random sample from the IEB. 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 employed subject to social security contributions on June 30$^{\text{th}}$, is also merged with the SIAB. For a detailed description of the BHP see Gruhl, Schmucker and Seth (2012) and of the SIAB see vom Berge, König and Seth (2013).

The basic sample selection restricts the empirical analysis to males of German nationality who graduated in West Germany from the Dual Education System.[6] 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 [cf. 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 nine 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 for an important part of the German workforce.

2.2. *Measurement*

The key regressor – early-career employment stability – is constructed by adding up all the days an individual was registered as full-time employed subject to social security contributions during the period between the start of the second and the end of the fifth experience year.[7] This measure captures the overall on-the-job experience accumulated within a stage of the career that is decisive for the professional development. Since tenure and unemployment spells are generally short for German apprentices, right-censoring of the key regressor should be less of an issue [cf. von Wachter and Bender (2006)].

The dependent variable of interest is the wage level achieved during a more settled stage. In the baseline specification, the adult wage is defined as the log

[6] The Dual Education System combines on-the-job training and vocational education at a school, cf. Hippach-Schneider, Krause and Woll (2007). Apprenticeship periods are recorded in the IEB because apprentices have to pay social security contributions.

[7] In this baseline specification, the first experience year is excluded because periods of initial job search or military service might blur the picture of stability. As will be shown in Section 5, the results do not depend on a specific measure of employment or wages.

of the real daily gross wage from dependent employment in the eighth year that has passed since graduation. If there are parallel spells at a 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, the wages are deflated to 2005 Euros using the CPI provided by the German Federal Reserve [cf. Deutsche Bundesbank (2012)].

The SIAB allows to observe a rich set of worker and establishment characteristics. With one exception, this information is extracted from the last training spell in order to construct the control variables. This has two advantages: First, differences in initial conditions which prevail at the time of labor market entry and might impact on both early-career employment stability and adult wage can be addressed for. Second, the interpretability of the regression results is ensured because the control variables are not themselves determined by the key regressor. The control variables comprise a polynomial of second order in age, characteristics of the training firm (such as wage level, size, sector, and the unemployment rate of the district in which the training firm is located), dummy variables for the occupation, and dummy variables for the cohort. Potential labor market experience is implicitly controlled for. For reasons outlined in Section 4.3.1, the aggregate unemployment rate prevailing during the eighth experience year is the only control variable measured after labor market entry.[8]

2.3. *Adult Wage Inequality and Early-career Employment (In-)Stability*

The adult wage distributions become more dispersed across the cohorts studied here. This is illustrated in Figure 1, which plots the ratio of the quantiles at each percentile of the adult log wage distribution between two particular graduation periods, providing an approximate growth-rate of wages. Specifically, the periods 1977 to 1979, 1987 to 1989, and 1999 to 2001 are contrasted.[9] By subtracting the median growth, the location of the wage growth distribution is kept constant. During the 1980s, the adult wage distribution remained fairly stable. In most cases, the quantiles do not differ significantly from each other. Only below the 35^{th} percentile as well as above the ninth decile significant but comparatively small declines in wage growth can be observed. The pattern at 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 at the upper tail has not yet accelerated during the 1980s in case of the subpopulation studied here. However, this is exactly what can be observed between the late 1980s and the late 1990s: While the quantiles above the median are increasing, the ones below the median are further decreasing during that time period. The comparison between the cohorts from the late 1970s and the

[8] See Section 8.1 for details on data cleansing, sample selection, and variable definitions.

[9] These are the same cohorts on which the IV strategy will focus. However, the results presented in this section do not hinge on this particular choice.

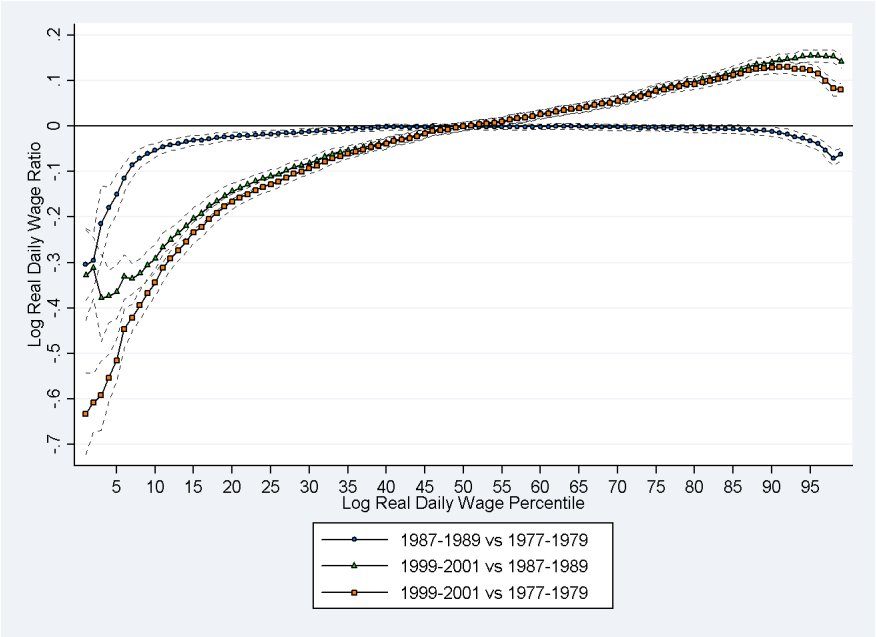

FIGURE 1.— Wage Growth Across the Adult Wage Distribution between Graduation Periods.

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

late 1990s provides a similar picture, suggesting that most distributional wage changes have taken place during the 1990s.

Turning to the distribution of youth employment, Figure 2 depicts the growth rates of the quantiles of early-career employment stability between different graduation periods.[10] About 15 percent of the individuals in a given cohort are continuously employed during the early career, irrespective of the time period under consideration. The probability of experiencing no single day of full-time employment during the early stage increases from four percent in the late 1970s to ten percent in the late 1990s. During the 1980s, the employment durations of medium length have moderately increased while the durations below the lower quartile have started to significantly decrease. During the 1990s, the decline of already comparatively short employment durations continued, whereas upper-tail inequality remained rather stable. Again, most of these distributional changes

[10]Some of the numbers underlying Figure 1 and Figure 2 can be found in Table VII in Appendix 8.2.

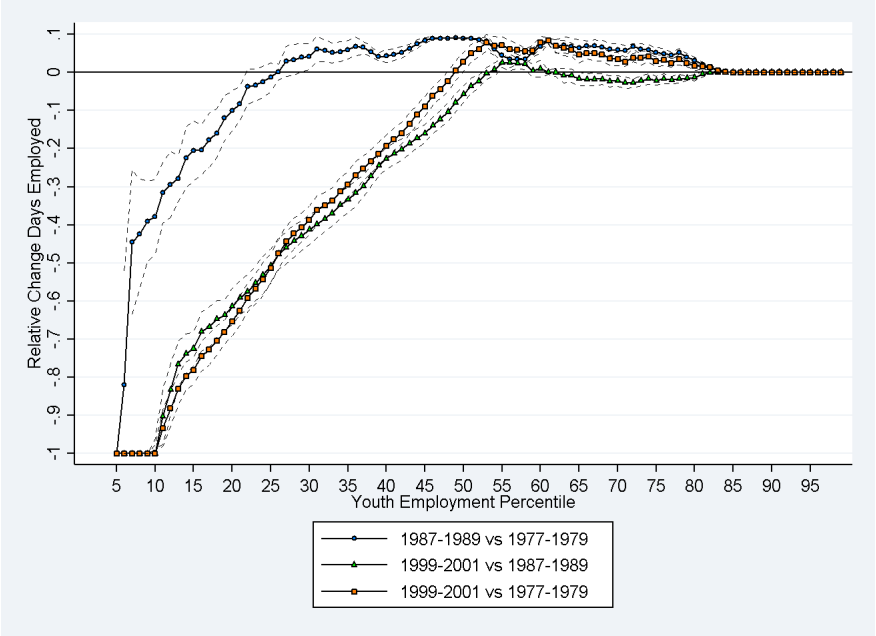

FIGURE 2.— Employment Growth Across the Youth Employment Distribution between Graduation Periods.

Notes: The figure plots the growth rate of youth employment at each percentile. Youth employment is measured as the total number of days full-time employed subject to social security contributions between the second and the fifth experience year. The cohorts are pooled over the respective graduation period. Dashed lines indicate 95% confidence intervals.

have taken place since the late 1980s.

3. CONCEPTUAL CONSIDERATIONS

Natural explanations for relative employment losses among young workers are provided by recent economic trends which, in interaction with adjustments of the institutional environment, change both the relative supply and the relative demand for tasks of a certain specificity, such as technological progress, internationalization, institutional change, changes in the employment relationship, and demographic change.

First, there is plenty of evidence that technological progress has increased the substitutability of certain tasks with capital and has enhanced the demand for specific skills that are complementary to capital [cf. Spitz-Oener (2006) for Germany or Acemoglu and Autor (2011) for the U.S.]. On the contrary, rising incentives for educational investment have induced shifts towards higher educational attainment [cf. Altonji, Bharadwaj and Lange (2012)]. If this adjustment is imperfect, however, workers who perform solely routine manual and routine cognitive tasks loose employment prospects relative to workers who carry out non-routine cognitive tasks [cf. Autor, Levy and Murnane (2003)].

A second potential explanation for relative employment losses for a certain group of young workers is internationalization. On the one hand, increasing competition on the labor market imposes pressure, particularly on young workers: Smith (2012) demonstrates that immigration of less skilled workers impacts considerably more on the employment outcomes for native youths than for native adults. On the other hand, intensified competition on the product market might have increased employers' needs for re-organization and management restructuring. As a consequence, employers might choose their workforce more thoroughly and seek to realize rationalization potentials by, for instance, the progressive use of down-sizing, offshoring, and outsourcing.[11] This, in turn, might complicate the formation of stable employer-employee relationships, particularly for young low skill workers.

Third, according to the OECD (1999), Germany still exhibits a high degree of employment protection relative to most other European countries.[12] In regard to employment stability, Pissarides (2001) discusses a strict employment protection legislation to prolong both the duration of employment and of unemployment by reducing employment terminations and hampering job creation. If particularly young low skill workers benefit less from employment protection because

[11] Outsourcing contributes to increasing segregation of workers between firms and occupations, cf. Abraham and Taylor (1996), Dube and Kaplan (2010), or Card, Heining and Kline (2013).

[12] During the mid 1980s to late 1990s, a variety of reforms that were aimed at increasing labor market flexibility by reducing employment protection were adopted. However, most of these regulations have been withdrawn by the reforms of 1999 and 2001, see Giannelli, Jaenichen and Villosio (2012) for an overview of labor market regulations concerning employment protection in Germany.

of insufficiently long job tenures, shifts are in favor of prime-aged men and at the expense of youths. Furthermore, Germany experienced a sharp decline in coverage rates of collective bargaining agreements after the turn of the century [cf. 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 [cf. Medoff (1979)], the impact of declining coverage on employment stability is ex-ante undetermined.

Fourth, alternative forms of employment besides full-time are increasingly gaining importance. For instance, Levenson (2000) finds the rates of involuntary part-time employment and of temporary work to have grown in the U.S. since the 1970s, particularly for young and low-skilled men and women [cf. also Segal and Sullivan (1997) on the rise of temporary work services]. Although depending on type, flexible staffing arrangements are more frequently used by firms to fill temporary vacancies than to provide bridges into regular full-time employment [cf. Houseman and Polivka (2000)].

Like many other European countries, finally, Germany faces an aging population as a consequence of demographic change. For West Germany, Garloff, Pohl and Schanne (2013) document that a decreasing cohort size has positive effects on the overall employment rate. Consequently, demographic change might counteract increasing employment instability in future decades.

The previous section demonstrates that the decline of early-career employment stability since the late 1980s has coincided with the increase of lower-tail adult wage inequality. This is not surprising since the macroeconomic trends outlined above provide the usual explanations for changes in the wage structure, too. However, declining employment stability early in professional life does not necessarily imply adverse consequences for career progression. The main theoretical argument for a causal link between current employment and future wages 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 [cf. Pissarides (1992) or Acemoglu (1995)] and negative signalling [cf. Vishwanath (1989) or Gibbons and Katz (1991)].[13] Since many presumably relevant factors are usually not observable in praxis, it is highly challenging to separate true state dependence from spurious correlations in empirical work.

To discuss potential sources of bias and to assess their impact on the estimates of the returns to early-career employment stability, I draw on a simple econometric model for the process of adult wage determination, which is inspired by von Wachter and Bender (2006): For individual i, the wage after a years on the

[13]Further explanations comprise lowering of reservation wages, loss of wage premia, or 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; cf. von Wachter and Bender (2006) or Schmillen and Umkehrer (2013) for further references.

labor market (w_{ia}) is a linear function of a column-vector of exogenous variables including a constant ($\mathbf{x}_{ig}$), which are determined at the time of graduation g, the overall work experience accumulated during youth y (d_{iy}), which is a period that lies between g and a, and an error term (o_{ia}):

$$w_{ia} = \mathbf{x}_{ig}^{\top}\beta_g + \alpha_a d_{iy} + o_{ia}. \tag{3.1}$$

β_g is a column-vector of parameters and α_a represents the *true* returns to employment stability. A superscript indicating the cohort is suppressed.

o_{ia} might be non-random for numerous reasons. As in von Wachter and Bender (2006), the discussion is focused on the following three possibly confounding factors: voluntary mobility, initial sorting, and adverse selection. First, it is assumed that each individual can attain a maximum number of days in employment during youth (e_{iy}). Employment stability can also be traded off against voluntary mobility (s_{iy}) [cf. Jovanovic (1979)]. The latter might for instance encompass time-consuming job-shopping or investments in further education and is likewise an important determinant of wage growth, next to general work experience [cf. Adda, Dustmann, Meghir and Robin (2013)]. The returns to mobility are denoted by γ_a. Both, e_{iy} and s_{iy} are latent and assumed to be mutually exclusive. Second, if more productive firms provide more stable jobs and offer higher wages, the wage after a experience years is also a function of the average productivity of the firm j that provided training to individual i ($\kappa_{j(i)g}$). Finally, if the individual's average productivity (κ_i), which is a function of innate ability and motivation, deviates from the firm's productivity, the individual might (have to) leave the firm. If there is voluntary mobility, initial sorting, and non-random selection, the error in the wage-setting process defined in (3.1) is composed of

$$o_{ia} = (\gamma_a - \alpha_a)s_{iy} + \kappa_{j(i)g} + (\kappa_{ig} - \kappa_{j(i)g}) + u_{ia}, \tag{3.2}$$

where u_{ia} is an idiosyncratic error term.

The probability limit of simple OLS estimates of α_a from (3.1), when o_{ia} is treated as random, is given by

$$\operatorname{plim}\hat{\alpha}_a^{OLS} = \alpha_a + (\gamma_a - \alpha_a)\frac{\operatorname{cov}(s_{iy}, d_{iy})}{\operatorname{var}(d_{iy})} + \frac{\operatorname{cov}(\kappa_{j(i)g}, d_{iy})}{\operatorname{var}(d_{iy})} + \frac{\operatorname{cov}(\kappa_{ig} - \kappa_{j(i)g}, d_{iy})}{\operatorname{var}(d_{iy})}. \tag{3.3}$$

Besides the true return, this estimate picks up bias stemming from the factors discussed above, as far as they are relevant. For the interpretability of this estimate, however, the sign of the *net* bias is decisive. Equation (3.3) gives some idea in which direction $\hat{\alpha}_a^{OLS}$ is, ceteris paribus, biased by each of the confounding factors: First, the presence of voluntary mobility implies $\operatorname{cov}(s_{iy}, d_{iy}) < 0$. Since stability is traded off against mobility only if the returns to mobility outweigh the returns to stability, $\gamma_a > \alpha_a$. Thus, the presence of voluntary mobility adds a negative term to (3.3) and therefore contributes to a downward bias.

Second, if more productive firms provide more stable jobs and pay higher wages, $\text{cov}(\kappa_{j(i)g}, d_{iy}) > 0$ and $\text{cov}(\kappa_{j(i)g}, w_{ia}) > 0$ [cf. Abowd, Kramarz and Margolis (1999) for evidence from France]. Consequently, the presence of non-random sorting introduces an upward bias, irrespective of the level of individual productivity. Finally, $\text{cov}(\kappa_{ig} - \kappa_{j(i)g}, d_{iy}) > 0$ and $\text{cov}(\kappa_{ig} - \kappa_{j(i)g}, w_{ia}) > 0$ if leavers constitute a negative selection. This is very likely the case for young graduates where screening of workers is of particular importance [cf. the discussion in von Wachter and Bender (2006) and the references therein]. The presence of negative selection might therefore bias the estimates of α_a^{OLS} upward. However, according to Card, Heining and Kline (2013), sorting of workers with a high earning potential into firms which are paying above-average wage premia is increasingly gaining importance for wage determination. In this case, an individual's productivity tends to be equal to the average firm productivity and selection has no persistent effect on wages.

Ultimately, there are different sources of bias, with a net effect on the estimate of the return to employment stability whose sign is ex-ante undetermined. In the following, a multivariate analysis is conducted to assess the direction of this bias, to identify the true returns, and to see how the relationship between youth employment and adult wage has developed over time.

4. REGRESSION RESULTS

4.1. *Mean Regression Results*

As a starting point, $E(w_a|d_y)$ from model (3.1) is estimated for each cohort from 1977 to 2002 separately, treating o_{ia} as random and setting β_g to zero. The variables are defined as described in Section 2.2. The corresponding semi-elasticities of adult wage with respect to early-career employment stability are depicted in Figure 3.[14] For all the cohorts studied here, the estimated average rates of return are positive and significantly different from zero. They exhibit no particular cyclical pattern and increase almost continuously from about 3.7 percent in the late 1970s to 13 percent in the late 1990s, when evaluated at one year of youth employment. The inclusion of the control variables leads to estimates that are slightly smaller but still statistically significant. However, the positive trend in the returns across cohorts remains unchanged. The average annual rate of return in the pooled sample with control variables and cohort dummies included is 6.6 percent.

[14]Modeling the functional form as a polynomial of second or third order in youth employment, and evaluating the marginal effects at the mean or the median, does not yield different results. Apart from that, the wage-employment profiles at the mean and at most quantiles of adult wages are close to linear, particularly for the cohorts from the late 1990s, as is shown by Figure 9 in Appendix 8.3. Therefore, and to avoid instrumentation of polynomials of higher order later on, the analyses in this section are restricted to the linear case.

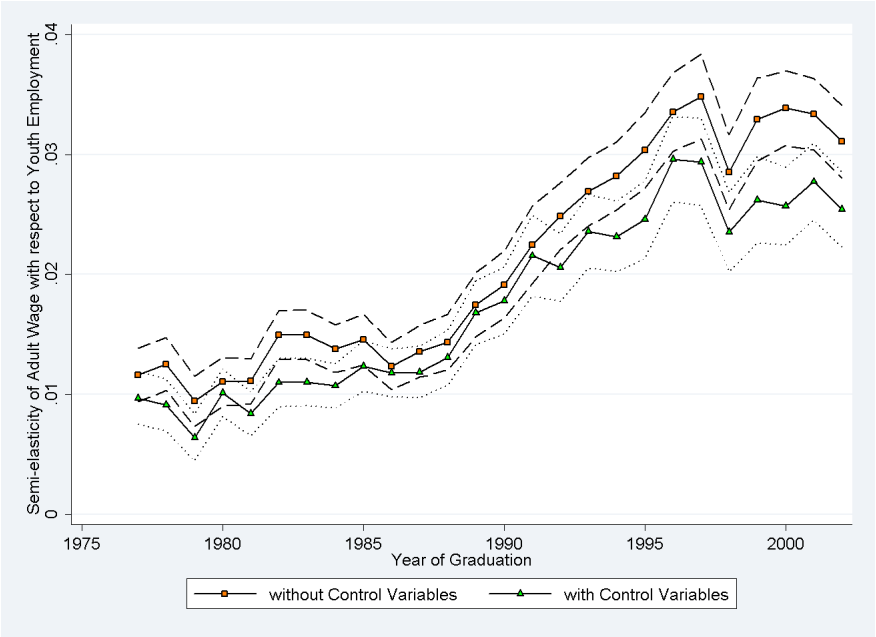

FIGURE 3.— Average Returns to Stability by Graduation Cohort (in %).

Notes: The figure plots the estimates of the returns to early-career employment stability from OLS regressions by graduation cohort. See the data appendix for definitions of the control variables. Dashed lines indicate 95% robust confidence intervals.

4.2. *Quantile Regression Results*

The effects on the conditional mean are mainly driven by effects at the lower tail of the adult wage distribution, as is documented in Figure 4. Now, the conditional θ-quantile of adult wage, $Q_\theta(w_a|d_y, \mathbf{x}_g)$, is estimated for $\theta \in \{0.1, 0.5, 0.7, 0.9\}$ by conditional quantile regressions [cf. Koenker and Bassett (1978)]. Most of the time, the effect on the 90^{th} percentile is not statistically different from zero. At the other quantiles studied, however, the returns are always positive and significantly different from zero. In general, the estimated returns decline across the adult wage distribution. From 1977 to 1988, this decrease appears parallel between cohorts, with the exception of the lower decile where a weak positive trend becomes visible. Between 1989 and 1996, however, the returns are starting to increase at the middle and at the bottom of the distribution, while they remain rather flat at the top. Moreover, this increase is more pronounced the lower the quantile. From 1997 onwards, this asymmetric growth has settled, leaving behind a larger difference between the returns across the wage distribution for a

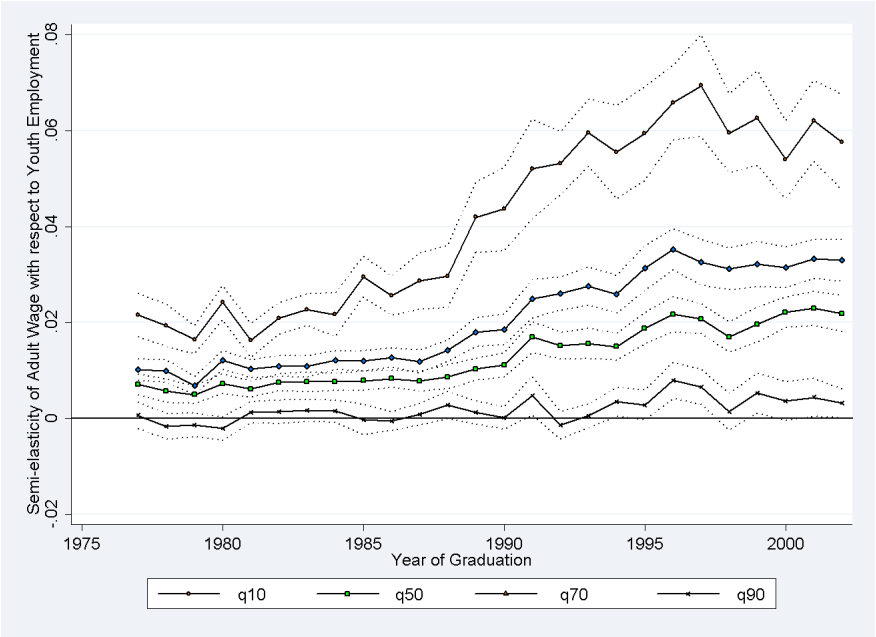

FIGURE 4.— Returns to Stability by Graduation Cohort at Selected Percentiles (in %).

Notes: The figure plots the estimates of the returns to early-career employment stability from conditional quantile regressions by graduation cohort. Control variables are included. See the data appendix for definitions of the control variables. Dashed lines indicate 95% robust confidence intervals, based on a simultaneous design-matrix-bootstrap with 500 replications.

given cohort as compared to the late 1970s.[15]

4.3. *Instrumental-variable Regression Results*

4.3.1. *Identification Strategy*

As discussed above, treating o_{ia} as random might result in biased estimates of the returns to stability if voluntary mobility, initial sorting, or non-random selection during early career involve persistent wage and employment effects. Ideally, what is needed to identify α_a from equation (3.1), if o_{ia} is determined according to equation (3.2), is variation in the maximum number of days in

[15] Omitting the control variables does not yield qualitatively different results. The same is true when $Q_\theta(w_a)$ is estimated with the RIF-regression approach introduced by Firpo, Fortin and Lemieux (2009), see Figure 8 in Appendix 8.3. Therefore, it can be concluded that the patterns documented in this section are not only specific to the conditional but also to the marginal distribution of adult wage.

employment attainable during early career (e_{iy}), which is conditionally orthogonal to voluntary mobility (s_{iy}), to unobserved firm productivity ($\kappa_{j(i)g}$), and to unobserved individual productivity (κ_i). Furthermore, this shock has to impact on later wages only indirectly via its effects on employment stability. Because an additional objective of the analysis is to comprehend how the returns have evolved over time, a similar type of variation has to be observable at different points in time.

I argue that within-cohort variation in the aggregate economic conditions prevailing at different stages of the early-career cycle is capable of accomplishing this complex task. As a measure for differences in the demand for labor on a daily basis, aggregate unemployment rates U (in percent) are calculated from the SIAB's full sample. Unemployment is hereby identified via the receipt of unemployment benefits. Next, a measure on an annual level is constructed by

$$U_t = \frac{1}{365} \sum_{p=365(t-1)+1}^{365t} U_p. \tag{4.1}$$

Once merged with the individual employment histories of the selected sample by the first day of each experience year, p indicates the number of days that have passed since graduation and t indicates the experience year.[16] For the just-identified case, the time dimension can be further reduced, where

$$U_y = \frac{1}{4} \sum_{t=2}^{5} U_t \tag{4.2}$$

is the instrumental variable that will be used in the IV regressions.[17]

To illustrate the actual identification strategy, Figure 5 plots the level and the one-year moving average of the unemployment rate by calendar day.[18] What is exploited for identification are the remarkable increases of unemployment in the course of economic crises. Three recessionary periods are in the focus of the analysis: First, the recession around 1982 as a consequence of the second oil-crisis. Second, the recession around 1992 which was induced by the end of the post-reunification boom and, finally, the recession around 2002 which was caused by the burst of the Internet bubble. Importantly, only those individuals who entered the labor market in the three years *prior* to each recession are contrasted. The corresponding graduation periods are marked in Figure 5, as are the periods during which the wage outcome is measured.

The IV strategy identifies a local average treatment effect (LATE) under the following assumptions:

[16] Leap years are included in the measure but ignored in equation 4.1 for simplicity.

[17] Various combinations of year increments as instrumental variables did not yield qualitatively different results. These regressions are not reported here but are available from the author upon request.

[18] Because of missing data on unemployment spells, the years 1975 and 1976 are excluded from the analysis.

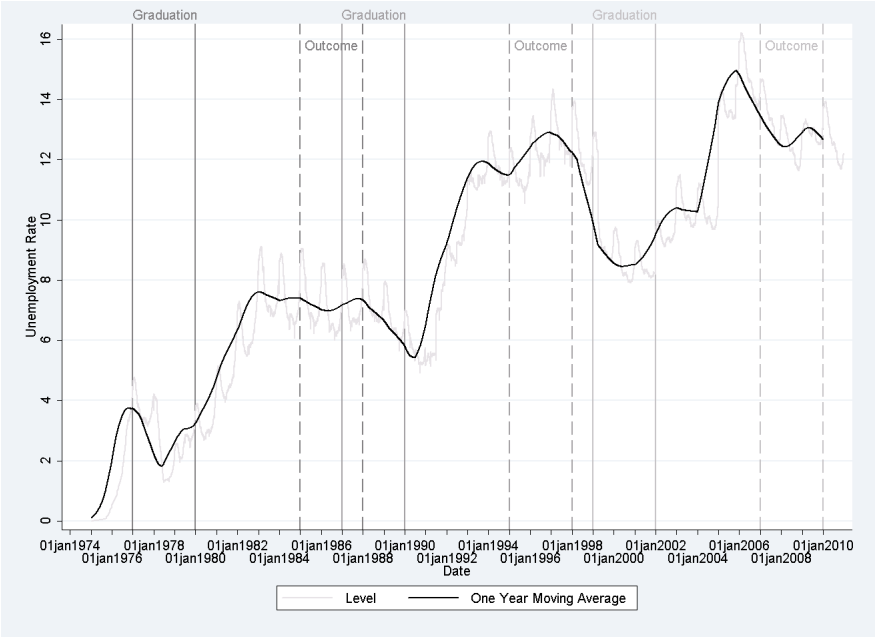

FIGURE 5.— Aggregate Unemployment Rates by Date (in %).

Notes: The figure plots the aggregate unemployment rate prevailing at 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.

- *A1 Relevance: The aggregate labor market conditions prevailing at different stages of the early-career cycle are correlated with youth employment.*
  This assumption is reasonable because workers are more prone to adverse economic conditions the less time they have spent on the labor market. Or, put differently, establishing a stable employer-employee relationship early in the career should be easier when economic conditions are favorable.
- *A2 Conditional Independence: Aggregate labor market conditions early in the professional career are independent of adult wage and early work experience, conditional on the control variables.*
  Since the instrument varies only with the day of graduation, a sufficient condition for this assumption to hold is that the day of graduation is exogenous in the process of adult wage determination. Graduation, in turn, is usually defined by successfully passing the final examination, which is predetermined by the training regime underlying the specific training occupation. In spite of the limited leeway for strategic choices, a rich set of control variables and cohort fixed-effects are included in the wage regres-

sions to hold initial conditions constant.[19] Furthermore, the IV analysis focuses on those young men who graduated during the periods 1977 to 1979, 1987 to 1989, and 1999 to 2001, respectively. Therefore, no individual enters the labor market during an economic downturn directly, which rules out anticipation effects to the greatest possible extent.

- *A3 Exclusion: After conditioning on early employment stability, the adult wage is independent of aggregate labor market conditions prevailing at different stages of the early-career cycle.*
  On the one hand, wages are measured at least eight years after graduation and under similar economic conditions. The functioning of the early career as an adjustment process suggests that individuals who struggled with low labor demand early on still have time to catch-up in any other matters than forgone work experience.[20] On the other hand, since all workers suffer through a recession at some point of their early career, everyone has lived through the same economic changes that have taken place until the wage outcome is measured. As suggested by Gregg (2001), any remaining persistence in aggregate labor market conditions is controlled for by including U_a in the wage regressions. Section 6 further discusses the validity of the exclusion restriction.

4.3.2. *Mean Instrumental-variable Regression Results*

The estimated coefficients on youth employment stability and on the instrumental variable U_y from mean regressions of adult wage or youth employment stability, respectively, are displayed together with robust standard errors in Table I. These regressions are carried out separately for the cohorts from the periods 1977 to 1979, 1987 to 1989, and 1999 to 2001. Each regression includes a constant and a dummy variable indicating December 31$^{\text{st}}$ as the day of graduation. Cohort effects as well as individual and establishment specific effects are successively controlled for. To provide a more intuitive interpretation of the results, the semi-elasticity of adult wage with respect to early-career employment stability evaluated at one year of full-time employment in youth, calculated as $100(e^{\hat{\alpha}_a 365} - 1)$, is displayed, too. Because of their relevance for assessing the validity of the IV procedure and their important economic implications, the first-stage and the reduced-form effects are explicitly addressed.

[19] Before 1991, an unreasonably high share of on average 57 percent of apprentices to graduate at the end of a calendar year was reported. This seems to appear systematically in cases where the former apprentice was hired by his training firm. Instead of introducing selection bias by omitting these observations, a dummy variable indicating December 31$^{\text{st}}$ as the day of graduation will be included in all IV regressions.

[20] Drawing on a data set similar to what is used in this study, Adda, Dustmann, Meghir and Robin (2013) report mobility rates among young graduates to increase right after a recession. Stevens (2010) shows that the wage effects of adverse economic conditions *at the time of labor market entry* fade away within seven years. This shows the importance of the early-career's adjustment mechanisms.

TABLE I

DIFFERENT ESTIMATES OF LOG REAL DAILY ADULT WAGE — BASELINE REGRESSIONS.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	1977-1979			1987-1989			1999-2001		
Regressions of adult wage									
OLS									
Youth employment ($\cdot 10^4$)	0.991***	1.021***	0.779***	1.366***	1.361***	1.318***	3.345***	3.343***	2.653***
	(6.39e-06)	(6.37e-06)	(6.17e-06)	(7.12e-06)	(7.11e-06)	(7.05e-06)	(9.33e-06)	(9.34e-06)	(9.84e-06)
Semi-elasticity (one year)	3.68	3.79	2.88	5.11	5.09	4.93	12.99	12.98	10.17
IV Second-stage									
Youth employment ($\cdot 10^4$)	-11.036***	3.572***	-0.132	11.953***	4.824***	2.391**	6.582***	7.626***	5.49***
	(0.0002)	(7.0e-05)	(9.1e-05)	(0.00037)	(0.0001)	(0.00012)	(9.5e-05)	(5.1e-05)	(0.0001)
Semi-elasticity (one year)	-33.16	13.93	-0.48	54.69	19.25	9.11	27.16	32.01	22.19
IV Reduced-form									
U_y	0.028***	-0.082***	0.002	-0.015***	-0.067***	-0.037*	-0.034***	-0.253***	-0.092***
	(0.0024)	(0.0152)	(0.0154)	(0.0027)	(0.0137)	(0.0190)	(0.005)	(0.0162)	(0.0177)
Regressions of youth employment									
IV First-stage									
U_y	-25***	-230***	-170***	-13***	-140***	-153***	-52***	-332***	-168***
	(3.7)	(23.6)	(25.8)	(3.8)	(19.2)	(27.3)	(5.9)	(19.2)	(21.4)
robust F-statistic	45.8***	95.1***	43.1***	11.6***	53***	31.4***	78.7***	300.8***	61.6***
Other variables included in regressions									
Cohort dummies		✓	✓		✓	✓		✓	✓
Individual/establishment			✓			✓			✓
Delayed report	✓	✓	✓	✓	✓	✓	✓	✓	✓
Constant	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of observations:	14,507	14,507	13,400	13,441	13,441	12,711	8,821	8,821	8,359

Notes: Robust standard errors in parentheses; * $p < .1$, ** $p < .05$, *** $p < .01$; IV regressions are performed with Hansen, Heaton and Yaron's (1996) continuously-updated GMM estimator implemented in the Stata command *ivregress*; The instrument is the aggregate unemployment rate averaged over the second to fifth experience year (U_y). Apart from the instrument, variables included in the regressions of youth employment are the same as in the estimates of adult wage. For variable definitions see Section 8.1.

Similar to the results from Section 4.1, the average returns estimated by OLS are positive, significant, and increasing. This holds irrespective of the models' specification. The returns estimated by OLS from models containing the full set of covariates suggest that one additional year of full-time employment in youth has increased the average adult wage by about three percent in the 1980s, by roughly five percent in the 1990s, and by about ten percent during the turn of the century, ceteris paribus. These effects are therefore not only statistically but also economically significant.

For the three oldest cohorts, the IV estimate of the average return from model (1) is negative and significantly different from zero.[21] This is the consequence of a positive reduced-form effect interacting with a negative first-stage effect, since the second stage is simply the reduced form divided by the first stage. The positive correlation between the unemployment rate prevailing at an early stage of the career and the future wage is a result of unobserved cohort effects. This can be seen from the regressions displayed in column (2). Controlling for cohort effects reveals both stronger negative first-stage and reduced-form effects. Furthermore, the inclusion of individual and establishment specific variables leads to a reduced-form effect that is no longer significantly different from zero. Consequently, the second-stage effect in column (3) should not be inter-

[21] All IV regressions are performed with Hansen, Heaton and Yaron's (1996) continuously-updated GMM procedure which generalizes the limited-information maximum likelihood estimator to the case of possibly heteroskedastic and autocorrelated disturbances and therefore provides estimates that are robust to heteroskedasticity, median-unbiased even in over-identified cases, and also efficient.

preted as causal.[22]

The IV regressions in columns (4) to (9) reveal reduced-form, first-stage, and second-stage effects that are significantly different from zero, at least on the ten percent level. For the graduates from the late 1980s, the second-stage effect in column (4) appears unreasonably large. This is because the first stage is estimated to be too weak relative to the reduced form if cohort effects are omitted. The IV estimates of the average return decline further once individual and training-firm characteristics are also controlled for. Yet, they remain significant at the five percent level, as becomes evident from column (6). The associated reduced-form and first-stage effects are significant and reasonable in size: A one-percentage point increase of the unemployment rate prevailing during early career, which is close to one standard deviation, decreases the average adult wage by about 3.7 percent and the number of days full-time employed during the second to fifth experience year by about five months. This lends support to *assumption A1: Relevance* stated in Section 4.3.1.

For the three youngest cohorts, the IV model displayed in column (9) suggests that the average return to early-career employment stability is not only significant but also larger compared with what was found for the older cohorts. Since the first stage is fairly stable across cohorts, this is the result of an increasing reduced-form effect. Finally, the first-stage F-statistic is in all cases significant and higher than ten, which indicates that there are no weak instrument problems.[23]

4.3.3. *Quantile Instrumental-variable Regression Results*

This section extends the IV analysis to the estimation of conditional quantile functions. As in Section 4.2, the conditional θ-quantile of adult wage, $Q_\theta(w_a|d_y, \mathbf{x}_g)$, is estimated for each percentile by conditional quantile regressions (QR) and quantile instrumental variable regressions (IVQR).[24] Again, the instrument is the aggregate unemployment rate averaged over the second to fifth experience year (U_y). As in the previous section, these regressions are carried out for those individuals who graduated during the periods 1977 to 1979, 1987 to 1989, and 1999 to 2001 separately. The results are depicted in Figure 6.

[22]This result does not imply that there is no causal effect. It rather shows that, despite of contemporary employment reductions, adverse economic conditions during early career did not have long-lasting effects on wages during the 1980s.

[23]The threshold of a F-statistic smaller than ten for whether an instrument appears weak is usually used as a rule of thumb, cf. Staiger and Stock (1997) and Stock, Wright and Yogo (2002).

[24]The IVQR procedure applied in this paper is introduced by Chernozhukov and Hansen (2005) and allows to instrument a continuous endogenous regressor in a quantile regression framework. Under the conditions stated therein, a quantile treatment effect (QTE) is identified without having to rely on functional form assumptions. The procedure was implemented on the basis of the Matlab command *inv_qr* and inference is based on Chernozhukov and Hansen (2008).

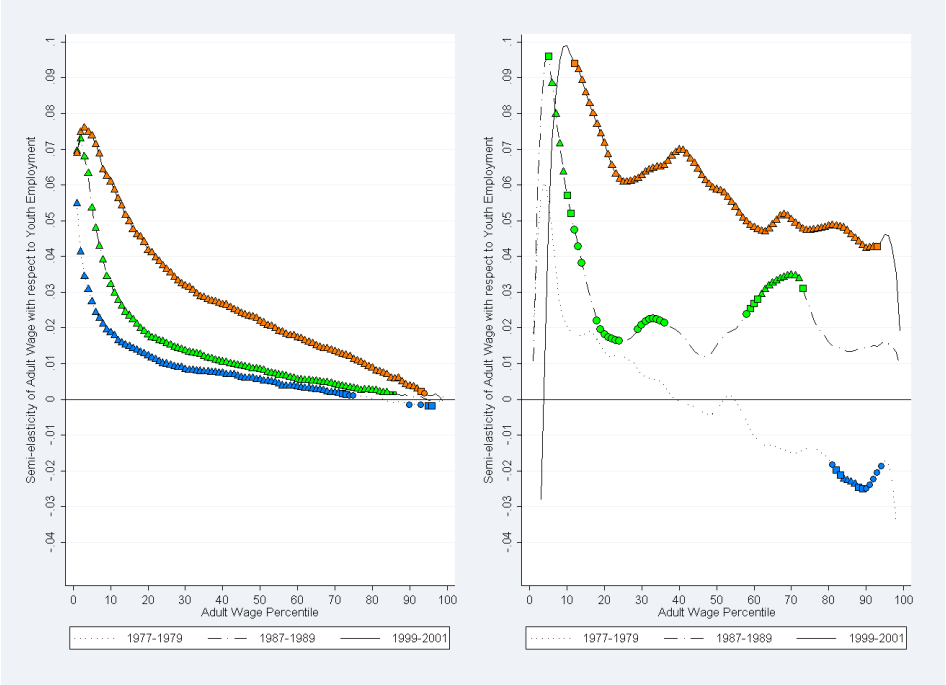

FIGURE 6.— Returns to Stability by Graduation Period at Adult Wage Percentiles (in %).

Notes: The figure plots the estimates of the returns to early-career employment stability from conditional quantile regressions (left panel) and quantile instrumental variable regressions (right panel) by graduation period. Triangles (squares) [circles] denote significance on the one (five) [ten] percent level. In the case of conditional quantile regressions, robust standard errors based on a simultaneous design-matrix-bootstrap with 500 replications are calculated. In the case of quantile instrumental variable regressions, analytical standard errors based on Chernozhukov and Hansen (2008) are calculated. The quantile instrumental variable procedure was implemented on the basis of the Matlab command *inv_qr*. The lowess-estimator with a bandwidth of 0.1 was used for smoothing. Model specifications are similar to those of columns (3), (6), and (9) of Table I. The instrument is the aggregate unemployment rate averaged over the second to fifth experience year (U_y). See the data appendix for definitions of variables and Figure 8 in Appendix 8.3 for results from unconditional quantile regressions.

The left panel of Figure 6 displays the semi-elasticity of adult wage with respect to early-career employment stability at each (conditional) percentile of the adult wage distribution for different graduation periods estimated by QR. As was already evident from Figure 4, the returns to employment stability are mostly positive, significant, and convexly decreasing across the adult wage distribution within each period under consideration. Furthermore, they have also increased asymmetrically between the cohorts. The corresponding results from the IVQR procedure are depicted in the right panel of Figure 6. As was outlined in the previous section, the second-stage effects for the oldest three cohorts permit no causal interpretation. The returns estimated by IVQR for graduates from the late 1980s are quite imprecise. However, the emerging pattern suggests that they are larger at the bottom than at the top of the distribution, larger than their QR counterparts, and smaller than the IVQR estimates of the returns for the youngest cohorts at each point of the wage distribution. The latter, in turn, are quite precisely estimated. They are larger than the QR estimates at each percentile and declining across the wage distribution. At the upper tail, they still show statistically and economically significant returns.

5. SENSITIVITY AND SPECIFICATION TESTS

In this section, the outcomes of a variety of sensitivity checks to evaluate whether the key finding of significant positive and increasing returns to early-career employment stability is robust to variations of the empirical setup are reported. The dynamics over the career cycle are investigated, too.

5.1. *Different Wage and Employment Measures*

A first series of robustness regressions reproduces the estimates presented in Table I, but this time with alternative measures for wages or employment, respectively. The early career is still defined over experience years two to five and wages are measured during the eighth year since graduation. For the sake of comparability, column (1) of Table II displays the baseline results from columns (3), (6), and (9) of Table I.

The specifications displayed in column (2) of Table II replace early-career employment stability with early-career job stability, constructed as the duration (in days) of the longest full-time job held within youth. This measure of stability can be frequently found in the literature and provides an interesting point of comparison. Taking account of Gathmann and Schönberg's (2010) finding that human capital is occupation or rather task specific, the total number of days spent full-time employed in the occupation with the longest overall duration accumulated by an individual during early career serves as measure in column (3). In column (4), early-career employment continuity, defined as the duration (in days) of the longest period of continuous full-time employment with any employer, is used instead of the total number of days; two employment spells are

TABLE II

DIFFERENT ESTIMATES OF LOG REAL DAILY ADULT WAGE — DIFFERENT WAGE AND EMPLOYMENT MEASURES.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Specification	Baseline wage measure				Baseline employment measure		
	Employment stability	Job stability	Occupational stability	Employment continuity	Wage, full-time jobs	Wage, main job	Wage, imputed
				1977-1979			
Regressions of adult wage							
OLS							
Youth employment ($\cdot 10^4$)	0.779***	0.771***	0.802***	0.728***	0.577***	0.768***	0.755***
	(6.17e-06)	(5.64e-06)	(5.93e-06)	(5.5e-06)	(5.6e-06)	(6.51e-06)	(6.6e-06)
Semi-elasticity (one year)	2.88	2.85	2.97	2.69	2.12	2.13	2.79
IV Second-stage							
Youth employment ($\cdot 10^4$)	-0.132	-0.192	-0.17	-0.147	-0.587	-1.193	-0.477
	(9.1e-05)	(1.33e-04)	(1.17e-04)	(1.0e-04)	(8.34e-05)	(9.94e-05)	(9.75e-05)
Semi-elasticity (one year)	-0.48	-0.7	-0.62	-0.54	-2.15	-4.26	-1.73
Regressions of youth employment							
IV First-stage							
U_y	-170***	-117***	-132***	-153***	-167***	-170***	-170***
	(25.8)	(24.8)	(24.9)	(26.7)	(25.8)	(25.8)	(25.8)
robust F-statistic	43.1***	22.2***	28.1***	32.9***	42.1***	43.2***	43.2***
Number of observations:	13,400	13,400	13,400	13,400	13,224	13,400	13,400
				1987-1989			
Regressions of adult wage							
OLS							
Youth employment ($\cdot 10^4$)	1.318***	1.302***	1.332***	1.223***	0.847***	1.322***	1.312***
	(7.05e-06)	(6.41e-06)	(6.73e-06)	(6.2e-06)	(6.03e-06)	(7.43e-06)	(7.09e-06)
Semi-elasticity (one year)	4.93	4.87	4.98	4.57	3.10	4.94	4.91
IV Second-stage							
Youth employment ($\cdot 10^4$)	2.391**	3.338*	2.586**	2.727*	1.896*	1.975	2.38*
	(1.2e-04)	(1.73e-04)	(1.32e-04)	(1.4e-04)	(0.00011)	(0.00012)	(0.00012)
Semi-elasticity (one year)	9.11	12.96	9.9	10.47	6.94	7.47	9.08
Regressions of youth employment							
IV First-stage							
U_y	-153***	-110***	-142***	-134***	-145***	-153***	-153***
	(27.3)	(25.5)	(26.4)	(28.1)	(27.4)	(27.3)	(27.3)
robust F-statistic	31.4***	18.6***	28.9***	22.9***	28.2***	31.5***	31.5***
Number of observations:	12,711	12,711	12,711	12,711	12,395	12,711	12,711
				1999-2001			
Regressions of adult wage							
OLS							
Youth employment ($\cdot 10^4$)	2.653***	2.633***	2.628***	2.555***	1.584***	2.7***	2.651***
	(9.84e-06)	(9.42e-06)	(9.48e-06)	(9.18e-06)	(8.01e-06)	(1.05e-05)	(9.86e-06)
Semi-elasticity (one year)	10.17	10.1	10.07	9.77	5.77	10.36	10.16
IV Second-stage							
Youth employment ($\cdot 10^4$)	5.49***	6.535***	5.657***	5.688***	6.215***	5.38***	5.481***
	(1.0e-04)	(1.29e-04)	(1.1e-04)	(1.1e-04)	(9.53e-05)	(0.00011)	(0.0001)
Semi-elasticity (one year)	22.19	26.94	20.7	23.07	22.7	21.7	22.15
Regressions of youth employment							
IV First-stage							
U_y	-168***	-141***	-163***	-162***	-176***	-168***	-168***
	(21.4)	(20.2)	(20.9)	(21.5)	(21.6)	(21.4)	(21.4)
robust F-statistic	61.6***	48.9***	60.9***	56.8***	66.2***	61.6***	61.6***
Number of observations:	8,359	8,359	8,359	8,359	7,824	8,359	8,359
Other variables included in regressions							
Cohort dummies	√	√	√	√	√	√	√
Individual/establishment	√	√	√	√	√	√	√
Delayed report	√	√	√	√	√	√	√
Constant	√	√	√	√	√	√	√

Notes: Robust standard errors in parentheses; * $p < .1$, ** $p < .05$, *** $p < .01$; IV regressions are performed with Hansen, Heaton and Yaron's (1996) continuously-updated GMM estimator implemented in the Stata command *ivregress*. Employment is measured during experience years two to five. Wages are measured during experience year eight. In (1) the baseline results from columns (3), (6), and (9) of Table I are displayed; in (2) the baseline employment measure is replaced by job stability, the duration in days of the longest full-time job; in (3) the baseline employment measure is replaced by occupational stability, the total number of days spent full-time employed in the occupation with the longest overall duration; in (4) the baseline employment measure is replaced by employment continuity, the duration in days of the longest period of continuous full-time employment; in (5) the baseline wage measure is replaced by the average daily wage from full-time jobs; in (6) the baseline wage measure is replaced by the daily wage from the longest job and with the highest wage; in (7) the baseline wage measure is corrected for top-coding by imputing latent values above the censoring point. The instrument is the aggregate unemployment rate averaged over the second to fifth experience year (U_y). Apart from the instrument, variables included in the regressions of youth employment are the same as in the estimates of adult wage. For variable definitions see Section 8.1.

connected only if there are less than three months between them.

Retaining the baseline employment measure, the regressions displayed in columns (5) to (8) of Table II provide estimates of the returns to early-career employment stability for different definitions of adult wage. In (5), wage observations are restricted to full-time jobs and averaged, weighted by duration, if there are multiple employment spells. Only the wage from the longest job with the highest wage is considered in (6). In column (7), top-coded wages are imputed in the SIAB's full sample using an imputation procedure based on tobit regressions similar to Card, Heining and Kline (2013).

According to the robustness regressions presented in Table II, the key results do not depend on a specific wage or employment measure. The results are not affected by censoring issues either.

5.2. *Different Estimation Designs*

Maintaining the wage and employment measures of the baseline approach, column (2) of Table III presents estimates of regressions that define early-career employment stability over the first five years since graduation. Accordingly, the instrument is the aggregate unemployment rate averaged over the first to fifth experience year. This is to make sure that the results do not hinge on the subjective decision to exclude the first experience year. Relative to the baseline results from Table I, which are also displayed in column (1) of Table III, the estimated returns are somewhat smaller. Qualitatively, however, there are no differences. The models of column (3), in contrast, define the early career as in the baseline approach but average wages over the eighth and ninth experience year. Since this decreases the probability of not observing an adult wage, the number of observations used in the regressions increases. The estimated returns, however, are quite similar to what was found for the baseline sample. This provides some evidence that the problem of systematic selection out of employment is probably not a sever one in this application.

A further potential problem are selective drop-outs. With about twenty percent, the annual rate of terminated contracts is generally high in Germany's Dual Education System. In almost two thirds of cases, terminations occur within the course of one year since the start of an apprenticeship [cf. Uhly (2012)]. Successful graduation, in turn, requires at least one year of training. Therefore, dropping observations on those apprentices with a training period shorter than one year, as is done in the models presented in column (4) of Table III, should also exclude most early drop-outs.[25] With the exception of the IV results for the cohorts from the late 1980s, the results for the restricted sample do not differ much from the baseline results. The returns estimated by IV for the late 1980s, however, are

[25] A substantial proportion of potential drop-outs was excluded by means of sample selection, already. However, generally excluding all individuals with an initial training period shorter than one year seems too restrictive given that a terminated contract reflects temporary interruptions of training in more than fifty percent of cases, according to Uhly (2012).

TABLE III

DIFFERENT ESTIMATES OF LOG REAL DAILY ADULT WAGE — ROBUSTNESS REGRESSIONS.

	(1)	(2)	(3)	(4)	(5)
Specification	Employment stability exp. years two to five	Employment stability exp. years one to five	Wages averaged over exp. years eight to nine	Length of training at least one year	Change of employer exp. years six to seven
			1977-1979		
Regressions of adult wage					
OLS					
Youth employment ($\cdot 10^4$)	0.779***	0.676***	0.69***	0.709***	0.474***
	(6.17e-06)	(5.41e-06)	(5.87e-06)	(6.53e-06)	(9.34e-06)
Semi-elasticity (one year)	2.88	2.5	2.55	2.62	1.75
IV Second-stage					
Youth employment ($\cdot 10^4$)	-0.132	-0.0989	0.21	-0.101	0.077
	(9.1e-05)	(9.43e-05)	(0.000085)	(0.00013)	(0.00014)
Semi-elasticity (one year)	-0.48	-0.36	0.77	-0.37	0.28
Regressions of youth employment					
IV First-stage					
U_y	-170***	-204***	-178***	-131***	-183***
	(25.8)	(37.0)	(25)	(29.3)	(37.4)
robust F-statistic	43.1***	30.4***	48.7***	20.0***	24.1***
Number of observations:	13,400	13,400	14,049	11,801	5,512
			1987-1989		
Regressions of adult wage					
OLS					
Youth employment ($\cdot 10^4$)	1.318***	1.14***	1.3***	1.23***	0.828***
	(7.05e-06)	(6.07e-06)	(6.8e-06)	(7.39e-06)	(1.03e-05)
Semi-elasticity (one year)	4.93	4.25	4.86	4.59	3.07
IV Second-stage					
Youth employment ($\cdot 10^4$)	2.391**	1.619**	2.06*	1.815	2.828
	(1.2e-04)	(8.0e-05)	(0.00012)	(0.00018)	(0.00028)
Semi-elasticity (one year)	9.11	6.09	7.81	6.85	10.87
Regressions of youth employment					
IV First-stage					
U_y	-153***	-324***	-111***	-110***	-118***
	(27.3)	(44.3)	(19.8)	(28.9)	(40.4)
robust F-statistic	31.4***	53.6***	31.4***	14.5***	8.63188***
Number of observations:	12,711	12,711	13,476	11,834	5,437
			1999-2001		
Regressions of adult wage					
OLS					
Youth employment ($\cdot 10^4$)	2.653***	2.311***	2.4***	2.433***	2.042***
	(9.84e-06)	(8.45e-06)	(9.1e-06)	(1.07e-05)	(1.49e-05)
Semi-elasticity (one year)	10.17	8.8	9.2	9.29	7.74
IV Second-stage					
Youth employment ($\cdot 10^4$)	5.49***	3.997***	5.8***	5.385***	6.595***
	(1.0e-04)	(7.52e-05)	(0.00009)	(0.00013)	(0.00022)
Semi-elasticity (one year)	22.19	15.71	23.58	21.72	27.22
Regressions of youth employment					
IV First-stage					
U_y	-168***	-248***	-188***	-146***	-135***
	(21.4)	(27.1)	(20.8)	(23.2)	(29.7)
robust F-statistic	61.6***	83.7***	82.7***	39.6***	20.8***
Number of observations:	8,359	8,359	8,757	7,420	3,896
Other variables included in regressions					
Cohort dummies	√	√	√	√	√
Individual/establishment	√	√	√	√	√
Delayed report	√	√	√	√	√
Constant	√	√	√	√	√

Notes: Robust standard errors in parentheses; * $p < .1$, ** $p < .05$, *** $p < .01$; IV regressions are performed with Hansen, Heaton and Yaron's (1996) continuously-updated GMM estimator implemented in the Stata command *ivregress*. In (1) the baseline results from columns (3), (6), and (9) of Table I are displayed; in (2) employment stability is measured during the first five years since graduation; in (3) wages are averaged over experience years eight and nine; in (4) individuals with an initial training period shorter than one year are excluded; in (5) individuals who at the end of experience year seven were employed by the same employer as at the end of experience year five are excluded. The instrument is the aggregate unemployment rate averaged over the second [first, in column (2)] to fifth experience year (U_y). Apart from the instrument, variables included in the regressions of youth employment are the same as in the estimates of adult wage. For variable definitions see Section 8.1.

smaller than the estimates from the baseline regressions and with a p-value of 0.3 no longer significant on the ten percent level.

Furthermore, the models presented in column (5) of Table III restrict the analysis to individuals who experienced a change of employer between the end of the early career and the beginning of adulthood. This mitigates the potential problem of correlation between the instrument and unobserved match quality: A direct connection between persistent match quality and the adult wage is disabled once individuals have changed employer during experience years six and seven. This is important because the exclusion restriction would be violated if the deterioration of the job-offer distribution available to an individual was permanent due to reasons other than the individual's past labor market experience. In this case, wage differences in adulthood would not only be a consequence of individual (un-)employment but also of differences in the quality of jobs, at least as long as they are not controlled for in the model for the wage setting process. As outline 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. The difference between the IV second-stage estimates and the OLS estimates in column (5) of Table III is, in absolute terms, larger in the restricted samples. Concurring with Neumark (2002), this is evidence for any correlation of the instrument with unobserved match quality biasing the IV estimates, if at all, towards finding no beneficial returns to stability.

5.3. *Dynamics Over the Career Cycle*

So far the impact of stable employment in youth on the wage distribution after a fixed number of experience years has been examined. This section sheds some light on the question of how these effects evolve over the career cycle within a group of individuals graduating under similar economic conditions but at different points in time. This is done by estimating the models from columns (3) and (6) of Table I but shifting a one-year window over adulthood. I.e. the first model is a regression of the wage prevailing in experience year six on early-career employment stability and the control variables. In the second model, the wage from the first model is replaced by the wage prevailing in experience year seven. This is repeated until the end of the observation period.[26] 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 are reported in Figure 7.

The average rate of return to early-career employment stability for individuals graduating during the late 1970s is significant and positive up to the 13^{th} experience year. However, the returns are convexly decreasing and no longer statistically different from zero after 14 years on the labor market. The pattern for

[26]The only control variable that is altered with the experience year is the aggregate unemployment rate.

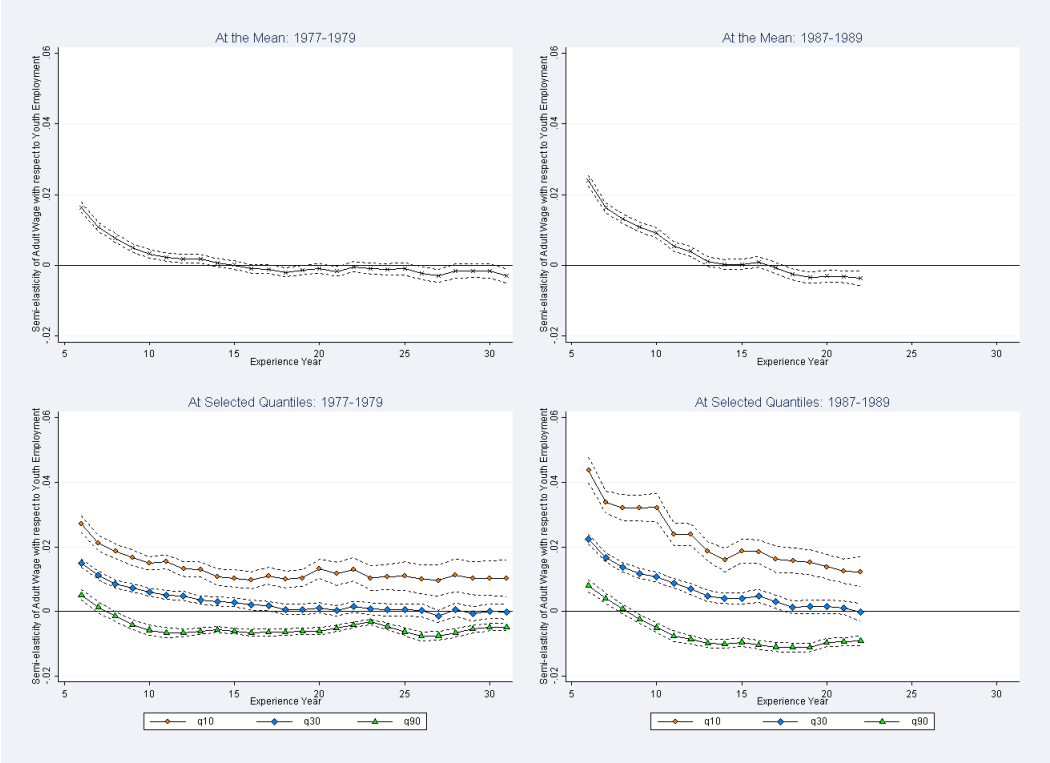

FIGURE 7.— Returns to Stability by Experience Year (in %).

Notes: The figure plots the estimates of the returns to early-career employment stability at the mean (first row) and selected deciles (second row) of the wage distribution observed in a given experience year for the cohorts of apprentices graduating 1977 to 1979 (first column) or 1987 to 1989 (second column), respectively. Dashed lines indicate 95% robust confidence intervals. In the case of mean regressions, inference is based on robust standard errors. In the case of conditional quantile regressions, robust standard errors based on a simultaneous design-matrix-bootstrap with 500 replications are calculated. Model specifications are similar to those of columns (3) and (6) of Table I. See the data appendix for definitions of variables.

the cohorts from the late 1980s is very similar except that the returns are on average larger and more rapidly declining. After 13 experience years they are no longer significant on the five percent level.

Even if evaluated at different points of the adult wage distribution, the returns follow a similar pattern over the career cycle but on different levels. After nine years, the returns at the ninth decile are significantly negative. The returns at the first decile, however, are estimated to be significantly positive over the entire observation period and the effects on the third decile behave very similar to the effects on the mean. Interestingly, the returns at the lower tail of the wage distribution are initially larger for the younger cohorts but converge to the estimates found for the older cohorts. Because the returns at the upper tail are even more negative for the younger cohorts, the effects are also more heterogenous across the wage distribution at different points of the career path for the graduates from the late 1980s.

The estimates presented in Figure 7 are likely to be biased. Particularly, as discussed in Section 3, unobserved patterns of job shopping or further educational attainment during the first years on the labor market might bias estimates of the beneficial returns to employment stability towards zero. Figure 10 in Appendix 8.3 re-estimates the returns to early-career employment stability displayed in the first row of Figure 7, using the aggregate unemployment rate averaged over the second to fifth experience year as an instrument for stability. For the late 1980s, the average returns estimated by IV remain positive and significantly different from zero over the observed part of the career cycle. Overall, the results are consistent with the view that, in the long-run, the returns to stability and the returns to mobility persist but, on average, cancel each other out to zero.

6. INTERPRETING THE REGRESSION RESULTS

Simple OLS estimates suggest that stable employment at an early stage of the professional career has on average positive effects on wages later in life. The essential question, however, is whether there is indeed a structural link between employment in youth and the wage outcome in adulthood, i.e. whether there is *true state dependence*. As an alternative explanation, serially correlated unobserved heterogeneity might be behind the positive relationship. If, and only if, there is a causal link, policy intervention can (potentially) influence future wage outcomes via altering the employment situation early on.

The multivariate regression analysis of the previous sections provides plenty of evidence that simple estimates of the returns to early-career employment stability are biased towards zero and therefore understate the true returns. This might appear counterintuitive at first glance. The simple econometric model describing the process of adult wage determination outlined in Section 3, however, demonstrates that a negative bias arises if employment stability is systematically traded off against mobility, involving for instance further educational attainment

and strategic job-shopping.

In regard to educational achievement, the results from regressions reported in Table IV show that controlling for successful participation in secondary or tertiary education during early career increases estimates of the returns to stability relative to omitting this information.[27] The estimates presented in columns (1),

TABLE IV

OLS Estimates of Log Real Daily Adult Wage — Controlling for Secondary or Tertiary Education.

	(1)	(2)	(3)	(4)	(5)	(6)
	1977-1979		1987-1989		1999-2001	
Youth employment ($\cdot 10^4$)	0.779^{***}	1.141^{***}	1.318^{***}	1.562^{***}	2.653^{***}	3.006^{***}
	(6.17e-06)	(6.2e-06)	(7.04e-06)	(7.32e-06)	(9.83e-06)	(9.9e-06)
Sec. or tert. education		0.1783^{***}		0.1038^{***}		0.1637^{***}
		(0.011)		(0.0125)		(0.0183)
$\chi^2(1)$	187.5^{***}		62.9^{***}		68.8^{***}	
Other variables included in regressions						
Cohort dummies	√	√	√	√	√	√
Individual/establishment	√	√	√	√	√	√
Delayed report	√	√	√	√	√	√
Constant	√	√	√	√	√	√
Number of observations:	13,400		12,711		8,359	

Notes: Standard errors in parentheses; * $p < .1$, ** $p < .05$, *** $p < .01$. The $\chi^2(1)$–statistic tests the null of equal coefficients on youth employment across the models within each period. For variable definitions see Section 8.1.

(3), and (5) of Table IV are identical to the OLS estimates from columns (3), (6), and (9) of Table I. The remaining three models additionally include a dummy variable indicating whether an individual has completed a secondary or tertiary education until the end of the seventh experience year. For each period, both models are estimated simultaneously and it is tested whether the returns to early-career employment stability do not statistically differ between the specifications. In all cases, this hypothesis is rejected on any reasonable significance level. Consistent with a downward bias, the returns to employment stability are also larger when successful participation in further education is controlled for. Since a higher education significantly increases the average wage in adulthood, the correlation between further education and total employment in youth has to be negative.[28]

The downward bias induced by further educational achievement can only explain 22 percent (for graduates from 1987 to 1989) and 12.5 percent (for graduates from 1999 to 2001) of the total net bias. The latter is revealed by the difference between the OLS and the corresponding IV second-stage estimates in

[27] In the sample of apprentices studied here, the probability of successfully participating in secondary or tertiary education during early career has increased from about eight percent for graduates from the late 1970s, to 10.1 percent for graduates from the late 1980s, up to 12.6 percent for graduates from the late 1990s.

[28] Because the decision to participate in further education is clearly endogenous, these estimates should be taken as illustrative.

columns (6) and (9) of Table I, respectively. Unfortunately, no direct information on voluntary job mobility is available in the SIAB. In regard to testing whether unobserved heterogeneity in the returns to search provides an additional explanation for downward biased OLS estimates, Neumark (2002) suggests to contrast estimates of the returns based on measures of employment stability with those based on measures of job stability. According to his theoretical model, the bias in OLS estimates in the former case should be smaller compared to the latter case if job-shopping provides a plausible explanation. As can be seen from column (1) versus column (2) of Table II, this is indeed the case.

Furthermore, the way how the non-IV estimates evolve over the career cycle is perfectly consistent with returns to mobility counteracting the beneficial returns to stability. The findings of Section 5.3 suggest that the returns to mobility outweigh the returns to stability for high wage earners, while the opposite appears to be the case for the low-paid. On average, both effects cancel each other out in the long-run. By focusing on the variation in work experience induced by differences in the demand for labor at different stages of the early career cycle, the IV strategy is able to put aside the effects of job-shopping and education.[29]

A further indication for downward biased estimates is the finding of decreasing returns across the adult wage distribution [cf. Figure 4 and Figure 6]. Particularly, non-IV estimates of quantile partial effects show no significant returns to stability at the top of the adult wage distribution.[30] This is inconsistent with, for instance, unobserved innate ability or motivation biasing the estimates upward.

Consistent with the econometric model of Section 3, controlling for individual and firm characteristics reveals a positive component of bias. Relative to the magnitude of the downward bias, however, it is quantitatively unimportant. One

[29]The probability limit of IV estimates of α_a from the model outlined in Section 3, if the instrument U_y is correlated with voluntary mobility s_y but orthogonal to any other element in equation (3.2), is given by $\alpha_a + (\gamma_a - \alpha_a)\text{cov}(s_{iy}, U_{iy})/\text{cov}(d_{iy}, U_{iy})$. If s_y reflects job shopping, $\text{cov}(s_{iy}, U_{iy}) < 0$ if individuals reduce their search effort when the demand for labor is low, $(\gamma_a - \alpha_a) < 0$ because the search effort is only reduced if the returns to stability are higher than the returns to mobility, and $\text{cov}(d_{iy}, z_{iy}) < 0$ as can be seen from the first-stage regressions. If s_y is time investment into further educational achievement, $\text{cov}(s_{iy}, U_{iy}) > 0$ if the lack of job offers induces individuals to participate in further education, which will only be the case if the returns to education outweigh the returns to further participating in the labor market, $(\gamma_a - \alpha_a) > 0$, and $\text{cov}(d_{iy}, U_{iy}) < 0$. In both cases, the IV estimates, if at all, tend to understate the true returns.

[30]It cannot be concluded that high wage earners do not profit from stable employment in the past, holding everything else constant. To see that the sign of the non-IV quantile regression estimates of the returns at the top of the wage distribution changes with the total employment duration in youth, Figure 9 plots the wage-employment profiles referred from quantile regressions adding early-career employment stability squared to the specifications of columns (3), (6), and (9) of Table I. For purpose of presentation, all other coefficients are set to zero. While the linearity assumption provides a sufficiently close approximation for modeling the quantile functions below the eighth decile, it results in negative returns (at short durations) and positive returns (at long durations) at the top to be averaged out to zero. However, the instrumental variable strategy is able to identify the beneficial returns to stability even at the upper two deciles, which are still smaller relative to the effects on the lower half of the wage distribution, cf. the right panel of Figure 6.

explanation for this discrepancy is that unobserved individual or firm heterogeneity are already – to a certain extent – controlled for by means of sample selection. As a second possibility, even though these characteristics are expected to impact on the quality of labor, its quantity might be much less affected.

Given the evidence, I argue that the estimates based on non-IV regressions presented in this paper identify a lower bound on the true returns to early-career employment stability. It is further reassuring that all of the findings still hold when the IV strategy is applied. However, since IV estimates identify a treatment effect for the subgroup of compliers, the returns estimated by IV constitute an upper bound if the individuals who are more prone to adverse economic conditions early in professional life profit more from stable employment than those who are not. Since Adda, Dustmann, Meghir and Robin (2013) provide evidence that low productivity workers are generally harder hit by recessions, this is likely to be true.

Furthermore, the observed patterns provide deeper insights into the underlying economic mechanisms: First, to the extent that high wage earners receive higher returns to human capital accumulation, decreasing returns to experience across the adult wage distribution appear incompatible with human capital theory. But the signalling model of Spence (1973) provides an alternative explanation[31]: For instance, if the relative demand for non-routine cognitive tasks increases, high skill workers might be better able to offset adverse consequences of instable employment histories. In contrast, if labor market competition among low skill workers intensifies, prospective employer are probably more selective against applicants with gaps in their curriculum vitae. Given that increasing labor market intermediation has simplified screening, a stable employment history might act as an increasingly important signal during the hiring process, particularly for workers supplying skills which are either frequently offered or rarely requested.

Second, according to the results, increasing employment stability early on would not only yield an overall higher wage level but also an adult wage distribution that is more compressed from the left. Since the returns to education generally increase across the wage distribution [cf. Buchinsky (1994) for the U.S., Fersterer and Winter-Ebmer (2003) for Austria, and Fitzenberger and Kurz (2003) for Germany], promoting on-the-job experience appears to be a more suitable measure compared to fostering education if reducing wage inequality is the sole aim.

Third, wage inequality has accelerated since the mid-1980s in the sample of apprentices studied here in quite a similar way than what was observed for

[31] In this framework, prospective employers form under asymmetric information subjective conditional probabilistic beliefs regarding an individual's productive capability based on available signals and time-invariant observable characteristics. These, in turn, determine the wage schemes offered to different groups within a cohort of apprentices. In the presence of market externalities, these might be asymmetrically adjusted with each cohort entering the labor market. Importantly, signals can only be informative if the costs of signalling are smaller for high wage earners.

the entire population. Because the returns to early-career employment stability are faster increasing at the bottom than at the top of the wage distribution, decreasing employment stability over time contributes particularly to lower-tail wage inequality. This source of growing wage inequality will be addressed in more detail in future research.

7. CONCLUSIONS

This article contrasts early careers and later wages of German males who graduated from the Dual Education System in West Germany between the years 1977 and 2001. Early-career employment stability, measured as the total duration of full-time employment accumulated during the first years on the labor market, has declined since the mid-1980s. However, these declines are limited to the lower tail of the early-career employment distribution, while durations above median length have even slightly prolonged. In terms of early on-the-job experience, the employment structure is increasingly polarizing within the group of workers studied here.

On average, workers receive positive returns to stable employment in the past. For ex-post low wage earners, these returns are substantial and persist over thirty years of potential experience. High wage earners, in contrast, receive smaller returns.

The returns to early-career employment stability have considerably increased over the observation period, primarily for low wage earners. Decreasing stability is therefore increasingly deteriorating career prospects for those affected and integrating young workers into the labor market should be of growing concern. Whether job offers via a Youth Guarantee, as recommended by the Council of the European Union (2013), can achieve this complex task remains an open question.

The findings of this study are likely to be conceptually relevant for other developed economies. On the one hand, the change of the wage structure towards higher inequality is observable in many industrialized countries. Although less frequently documented, declining employment stability particularly among young workers does not appear to be specific to the present case of German apprentices either. This may not be surprising since the underlying trends in the economic environment operate internationally. On the other hand, despite of clear differences in the institutional environment, the youth labor market in Germany exhibits remarkable similarities to e.g. the one in the U.S. [cf. von Wachter and Bender (2006)]. Furthermore, Ryan (2001) emphasizes that an economic mechanism as fundamental as state dependence is unlikely to be only specific to one nation.

But I also have 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 (cross-country) evidence derived with the help of more structural

approaches or even natural experiments. This is because an IV approach like the one applied in the present paper has always to be treated with caution due to the strong assumptions it involves.

In conclusion, many countries that currently have to struggle with a high unemployment rate among their young workforce seek to facilitate the training-to-work transition and to encourage early investments into human capital. In this context, an apprenticeship system is often regarded as a promising benchmark for the implementation of more efficient school-to-work programs [see for example the discussion in Harhoff and Kane (1997) or Neumark (2002)]. While, until the late 1980s, 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, this does no longer seem to be the case today. Hence, the implementation of similar systems in itself will probably not suffice to tackle the youth (un-)employment problem.

In how far demographic change, educational adjustments, or institutional reforms will counteract the divergence of wages, employment, and the returns to early-career employment stability in future decades remains to be seen.

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REFERENCES

Abowd, John M.; Kramarz, Francis and Margolis, David N. (1999). Why Do Firms Train? Theory and Evidence. *Econometrica* **62** 161–178.

Abraham, Katherine and Taylor, Susan (1996). Firms' Use of Outside Contractors: Theory and Evidence. *Journal of Labor Economics* **14** 394–424.

Acemoglu, Daron (1995). Public Policy in a Model of Long-Term Unemployment. *Economica* **67** 251–333.

Acemoglu, Daron and Autor, David (2011). Skills, Tasks and Technologies: Implications for Employment and Earnings. In Ashenfelter, O. and Card, D. (Eds.). *Handbook of Labor Economics* **Vol. IV, Part B** 1043–1171., Elsevier.

Adda, Jerome; Dustmann, Christian; Meghir, Costas and Robin, Jean-Marc (2013). Career Progression, Economic Downturns, and Skills. *Mimeo.*

Altonji, Joseph G.; Bharadwaj, Prashant and Lange, Fabian (2012). Changes in the Characteristics of American Youth: Implications for Adult Outcomes. *Journal of Labor Economics* **30** 783–828.

Antonczyk, Dirk; Fitzenberger, Bernd and Sommerfeld, Katrin (2010). Rising wage inequality, the decline of collective bargaining, and the gender wage gap. *Labour Economics* **30** 835-847.

Atkinson, John (1996). Employers, Recruitment and the Unemployed, Institute for Employment Studies Report 325, *Grantham Book Services*, Grantham, United Kingdom.

Autor, David H. (2009). Introduction to Studies of Labor Market Intermediation. In Autor, D. (Eds.). *Studies in Labor Market Intermediation*, University of Chicago Press, Elsevier.

Autor, David H.; Levy, Frank and Murnane, Richard J. (2003). The Skill Content of Recent Technological Change: An Empirical Exploration. *The Quarterly Journal of Economics* **118** 1279–1333.

Bartel, Ann and Borjas, George (1981). Wage Growth and Job Turnover. In Sherwin, R. (Eds.). *Studies in Labor Markets* 65–90, University of Chicago Press, Elsevier, Chicago

vom Berge, Philipp; König, Marion and Seth, Stefan (2013). Stichprobe der Integrierten Arbeitsmarktbiografien (SIAB) 1975 – 2010. *FDZ Datenreport 01/2013*.

Bergmann, Annette and Mertens, Antje (2011). Job Stability Trends, Lay-offs, and Transitions to Unemployment in West Germany. *Review of Labour Economics and Industrial Relations* **25** 421-446.

Bernhardt, Annette; *Morris, Martina*; Handcock, Mark S. and Scott, Marc A. (1999). Trends in Job Instability and Wages for Young Adult Men. *Journal of Labor Economics* **17** 65–90.

Blanchard, Olivier J. and Diamond, Peter A. (1994). Ranking, Unemployment Duration, and Wages. *Review of Economic Studies* **61** 417-434.

Blanchflower, David G. and Oswald, Andrew J. (1994). The Wage Curve. *MIT Press*, Cambridge, MA.

Blossfeld, Hans-Peter (1987). Labor-Market Entry and the Sexual Segregation of Careers in the Federal Republic of Germany. *American Journal of Sociology* **93** 89–118.

Buchinsky, Moshe (1994). Changes in the U.S. Wage Structure 1963-1987: Application of Quantile Regression. *Econometrica* **62** 405–458.

Card, David; Heining, Jörg and Kline, Patrick (2013). Workplace Heterogeneity and the Rise of West German Wage Inequality. *The Quarterly Journal of Economics* **128** 967–1015.

Chernozhukov, Victor and Hansen, Christian (2005). An IV model of quantile treatment effects. *Econometrica* **73** 245–261.

Chernozhukov, Victor and Hansen, Christian (2008). Instrumental variable quantile regression: A robust inference approach. *Journal of Econometrics* **142** 379–398.

Deutsche Bundesbank (2012). *http://www.bundesbank.de; Time series BBK01.UJFB99: Consumer price index*, retrieved in February 2012, Deutsche Bundesbank, Frankfurt am Main.

Dube, Arindrajit and Kaplan, Ethan (2010). Does Outsourcing Reduce Wages in the Low-Wage Service Occupations? Evidence from Janitors and Guards. *Industrial and Labor Relations Review* **63** 287–306.

Dustmann, Christian; Ludsteck, Johannes and Schönberg, Uta (2009). Revisiting the German Wage Structure. *Quarterly Journal of Economics* **124** 843–881.

Eberle, Johanna; Jacobebbinghaus, Peter; Ludsteck, Johannes and Witter, Julia (2011). Generation of time-consistent industry codes in the face of classification changes - Simple heuristic based on the Establishment History Panel (BHP). *FDZ Datenreport 05/2011 (en)*.

European Union (2013). Council recommendation of 22 April 2013 on establishing a Youth Guarantee. *Official Journal of the European Union* **C 120/01**.

Farber, Henry S. (1993). The Incidence and Cost of Job Loss: 1982-1991. *Brookings Papers on Economic Activity: Microeconomics* 73-132.

Fersterer, Josef and Winter-Ebmer, Rudolf (2003). Are Austrian returns to education falling over time? *Labour Economics* **10** 73–89.

Firpo, Sergio; Fortin, Nicole M. and Lemieux, Thomas (2009). Unconditional Quantile Regressions. *Quarterly Journal of Economics* **124** 953-973.

Fitzenberger, Bernd and Kurz, Claudia (2003). New insights on earnings trends across skill groups and industries in West Germany. *Empirical Economics* **28** 479–514.

Gathmann, Christina and Schönberg, Uta (2010). How General is Human Capital? A Task-Based Approach. *Journal of Labor Economics* **28** 1–49.

Gardecki, Rosella and Neumark, David (1998). Order from Chaos? The Effects of Early Labor Market Experiences on Adult Labor Market Outcomes. *Industrial and Labor Relations Review* **51** 299-322.

Garloff, Alfred; Pohl, Carsten and Schanne, Norbert (2013). Do small labor market

entry cohorts reduce unemployment? *Demographic Research* **29** 379–406.

Giannelli, Gianna; Jaenichen, Ursula and Villosio, Claudia (2012). Have labor market reforms at the turn of the millennium changed the job and employment durations of new entrants? A comparative study for Germany and Italy. *Journal of Labor Research* **33** 143–172.

Gibbons, Robert and Katz, Lawrence (1991). Layoffs and Lemons. *Journal of Labor Economics* **9** 351–380.

Gregg, Paul (2001). The Impact of Youth Unemployment on Adult Unemployment in the NCDS. *Economic Journal* **109** 626–653.

Gruhl, Anja; Schmucker, Alexandra and Seth, Stefan (2012). The Establishment History Panel 1975–2010 *FDZ Datenreport 04/2012*.

Hansen, Lars P.; Heaton, John and Yaron, Amir (1996). Finite-Sample Properties of Some Alternative GMM Estimators. *Journal of Business & Economic Statistics* **14** 262–280.

Harhoff, Dietmar and Kane, Thomas J. (1997). Is the German apprenticeship system a panacea for the U. S. labor market? *Journal of Population Economics* **10** 171-196.

Heckman, James and Borjas, George (1980). Does Unemployment Cause Future Unemployment? Definitions, Questions and Answers from a Continuous Time Model of Heterogeneity and State Dependence. *Economica* **47** 247–283.

Hippach-Schneider, Ute; Krause, Martina and Woll, Christian (2007). *Vocational Education and Training in Germany: Short Description*, European Centre for the Development of Vocational Training, Thessaloniki.

Houseman, Susan N. and Polivka, Anne E. (2000). The Implications of Flexible Staffing Arrangements for Job Stability. In Neumark, D. (Eds.). *On the Job – Is Long-Term Employment a Thing of the Past?* **Chapter 12** 427–462,*Russell Sage Foundation*, New York.

Jacobson, Louis S.; LaLonde, Robert J. and Sullivan, Daniel G. (1993). Earnings Losses of Displaced Workers. *The American Economic Review* **83** 685–709.

Jovanovic, Boyan (1979). Firm-specific Capital and Turnover. *Journal of Political Economy* **87** 1246-1260.

Koenker, Roger and Bassett, Gilbert (1978). Regression Quantiles. *Econometrica* **46** 33–50.

Levenson, Alec R. (2000). Long-Run Trends in Pert-Time and Temporary Employment: Toward an Understanding. In Neumark, D. (Eds.). *On the Job – Is Long-Term Employment a Thing of the Past?* **Chapter 10** 335–397,*Russell Sage Foundation*, New York.

Medoff, James L. (1979). Layoffs and Alternatives under Trade Unions in U.S. Manufacturing. *The American Economic Review*. **69** 380–395.

Mincer, Jacob (1962). On-the-Job Training: Costs, Returns, and Some Implications. *Journal of Political Economy*. **70** 50–79.

Monks, James and Pizer, Steven (1998). Trends in Voluntary and Involuntary Turnover. *Industrial Relations*. **37** 440–459.

Neumark, David (2000). On the Job – Is Long-Term Employment a Thing of the Past? *Russell Sage Foundation*, New York.

Neumark, David (2002). Youth Labor Markets In The United States: Shopping Around Vs. Staying Put. *The Review of Economics and Statistics* **84** 462–482.

Oberschachtsiek, Dirk; Scioch, Patrycja; Seysen, Christian and Heining, Jörg (2009). Integrated Employment Biographies Sample IEBS: Handbook for the IEBS in the 2008 Version. *FDZ Datenreport 03/2009*.

OECD Employment Outlook (1999). *Employment Protection and Labour Market Performance, Chapter 2*, OECD, Paris.

Oreopoulos, Philip; von Wachter, Till and Heisz, Andrew (2012). The Short- and Long-Term Career Effects of Graduating in a Recession. *American Economic Journal: Applied Economics* **4** 1–29.

Pissarides, Christopher A. (1992). Loss of Skill during Unemployment and the Persistence of Employment Shocks. *Quarterly Journal of Economics* **107** 1371–1391.

Pissarides, Christopher A. (2001). Employment protection. *Quarterly Journal of Economics* **8** 131-159.

Ryan, Paul (2001). The School-to-Work Transition: A Cross-National Perspective. *Journal of Economic Literature* **39** 34–92.

Schmieder, Johannes; Wachter, Till von and Bender, Stefan (2010). The Long-term Impact of Job Displacement in Germany During the 1982 Recession on Earnings, Income, and Employment *IAB Discussion Paper 01/2010*.

Schmillen, Achim and Umkehrer, Matthias (2013). The Scars of Youth - Effects of Early-Career Unemployment on Future Unemployment Experiences. *IAB Discussion Paper 06/2013*.

Segal, Lewis and Sullivan, Daniel (1997). The Growth of Temporary Services Work. *Econometrica* **65** 557–586.

Smith, Christopher L. (2012). The Impact of Low-Skilled Immigration on the Youth Labor Market. *Journal of Labor Economics* **30** 55–89.

Spence, Michael (1973). Job Market Signaling. *The Quarterly Journal of Economics* **87** 355–374.

Spitz-Oener, Alexandra (2006). Technical Change, Job Tasks, and Rising Educational Demands: Looking outside the Wage Structure. *Journal of Labor Economics* **24** 235–270.

Staiger, Douglas and Stock, James (1997). Instrumental Variables Regression with Weak Instruments. *Econometrica* **65** 557–586.

Stevens, Katrien (2010). Adverse Economic Conditions at Labour Market Entry: Permanent Scars or Rapid Catch-up? *Mimeo, University of Sydney*.

Stock, James; Wright, Jonathan and Yogo, Motohiro (2002). A Survey of Weak Instruments and Weak Identification in Generalized Method of Moments. *Journal of Business & Economic Statistics* **20** 518–529.

Stuart, Jay (2002). Recent Trends in Job Stability and Job Security: Evidence from the March CPS. *Bureau of Labor Statistics Working Paper 356*.

Topel, Robert and Ward, Michael (1992). Job Mobility and the Careers of Young Men. *The Quarterly Journal of Economics* **107** 439–479.

Uhly, Alexandra (2012). Weiterhin hohe Quote vorzeitig gelöster Ausbildungsverträge. In *BWP – Berufsbildung in Wissenschaft und Praxis* **2** 4–5,*Bundesinstitut für Berufsbildung*, Bonn.

Vishwanath, Tara (1989). Job Search, Stigma Effect, and Escape Rate from Unemployment. *Journal of Labor Economics* **7** 487–502.

von Wachter, Till and Bender, Stefan (2006). In the Right Place at the Wrong Time: The Role of Firms and Luck in Young Workers' Careers. *The American Economic Review* **96** 1679-1705.

Winkelmann, Rainer (1996). Employment Prospects and Skill Acquisition of Apprenticeship-Trained Workers in Germany. *Industrial and Labor Relations Review* **49** 658–672.

8. APPENDIX

8.1. *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 less 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 three percent of cases. In general, graduation is identified by the last day of the first training period. Individuals who are older than 26 years at the beginning of this period are excluded.

In Germany's Dual Education System, the annual rate of terminated contracts is about twenty percent. Most terminations occur within the course of one year since the start of an apprenticeship. In more than fifty percent of these cases, however, the individuals return to the education system by starting a second apprenticeship [cf. Uhly (2012)]. If there are multiple training periods, the end of the subsequent period is defined as graduation only if it lasts longer than the previous one, if the previous period is shorter than one year, if less than 92 days lie between the two periods, and if the individual is younger than 27 years 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 years and younger than 31 years at the time of graduation enter the sample. Furthermore, nine percent of the remaining individuals hold an Abitur or even a degree from tertiary education before the start of apprenticeship training. These are excluded, too.

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

Among the remaining apprentices, all women are excluded because of their comparatively weak attachment to the labor market. Furthermore, only individuals registered as German citizens at some point in time are selected. Moreover, 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 individuals with the one percent highest and lowest adult wages in the full sample are dropped.

To avoid the problem of "bad controls", 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 losses 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 adulthood is used as an additional control variable. See Section 4.3.1 for further details.
- *Delayed report:* Due to peculiarities of the reporting system, a considerable proportion of employers report December 31st as the day of graduation before 1991. This comprises a problem for the validity of the identification strategy outlined in Section 4.3.1 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:* 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 services occupations, skilled services occupations, semi-professions and professions, unskilled commercial occupations, skilled commercial occupations, and managers. The reference category is unskilled manual occupations. Be-

cause the variable capturing the occupation exhibits some missing values, a dummy variable indicating missing values is included, too.

- *Sector of the training firm:* 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 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, for instance caused by differences in size or composition. Furthermore, they control for longer-term trends, e.g. related to the economic cycle or the quality of the Dual Education System, too.

Mean, standard deviation, minimum, and maximum of the key and the control variables are presented in Table V and Table VI of Appendix 8.2. The first table describes the full sample while the second table characterizes the samples used within the IV approach.

In the full sample, the average age at graduation is 19.5 years. During the second to fifth experience year, the individuals spent an average of two and a half years in full-time employment. The standard deviation of this variable is with 1.3 years quite high. 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 is decreasing over time.

Turning to individuals who entered the labor market in the three years prior to the severe recessions of the years 1980, 1990, and 2002, respectively, Table VI reveals that the average graduation age is continuously increasing. This is, on the one hand, because individuals from younger cohorts begin their training later and, on the other hand, because training periods are getting longer. The relative frequencies of the trained occupations, 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, the average firm-size is declining. 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 in youth goes up by one month from the late 1970s to the late 1980s, and drops by more than three months from the late 1980s to the late 1990s. The variability in employment durations is continuously and substantially increasing across the three periods considered here. At the same time, adult wage inequality is increasing.

8.2. *Supplementary Tables*

TABLE V

SUMMARY STATISTICS – FULL SAMPLE.

All cohorts (N = 98,048)				
Variable	Mean	Standard deviation	Minimum	Maximum
Adult wage	4.33	0.345	2.50	4.99
Youth employment	932	480	0	1,461
Age	19.45	1.85	15	30
Age squared	381.74	75.31	225	900
Firm wage	56.52	20.46	1.96	147.95
Firm size	989	4,449	1	62,825
District UR	7.36	3.35	0.9	19.8
Adult UR	9.84	2.61	5.43	14.95
Delayed report	0.418	0.493	0	1
Occupation				
Agricultural	0.018	0.132	0	1
Unskilled manual	0.083	0.276	0	1
Skilled manual	0.644	0.479	0	1
Technical	0.030	0.170	0	1
Unskilled service	0.017	0.130	0	1
Skilled service	0.011	0.106	0	1
(Semi)professions	0.014	0.116	0	1
Unskilled commerc.	0.026	0.159	0	1
Skilled commerc.	0.128	0.334	0	1
Missing	0.029	0.169	0	1
Industry				
Agriculture	0.014	0.116	0	1
Energy/mining	0.025	0.155	0	1
Manufacturing	0.490	0.500	0	1
Construction	0.175	0.380	0	1
Trade	0.122	0.328	0	1
Transport/communic.	0.040	0.196	0	1
Financial intermed.	0.021	0.145	0	1
Other services	0.084	0.277	0	1
Non-profits	0.007	0.082	0	1
Public admin.	0.022	0.147	0	1
Cohort				
1977	0.047	0.211	0	1
1978	0.044	0.206	0	1
1979	0.045	0.208	0	1
1980	0.047	0.212	0	1
1981	0.050	0.219	0	1
1982	0.050	0.218	0	1
1983	0.048	0.214	0	1
1984	0.049	0.216	0	1
1985	0.049	0.216	0	1
1986	0.049	0.216	0	1
1987	0.048	0.213	0	1
1988	0.043	0.203	0	1
1989	0.039	0.193	0	1
1990	0.036	0.187	0	1
1991	0.022	0.147	0	1
1992	0.033	0.178	0	1
1993	0.034	0.181	0	1
1994	0.035	0.183	0	1
1995	0.029	0.169	0	1
1996	0.029	0.167	0	1
1997	0.028	0.166	0	1
1998	0.031	0.174	0	1
1999	0.028	0.165	0	1
2000	0.029	0.167	0	1
2001	0.029	0.167	0	1
2002	0.029	0.167	0	1

Table VI: Summary Statistics – IV Estimation Sample.

1977-1979 (N = 13,400)				
Variable	Mean	Standard deviation	Minimum	Maximum
Adult wage	4.30	0.271	2.50	4.93
Youth employment	954	429	0	1,461
Age	18.62	1.78	15	29
Age squared	349	71	225	841
District UR	3.88	1.43	0.9	8.2
Adult UR	7.20	0.1578	6.99	7.40
Delayed report	0.673	0.469	0	1
Firm wage	35.86	8.54	4.12	67.46
Firm size	1,090	4,571	1	53,166
Occupation				
Agricultural	0.017	0.130	0	1
Unskilled manual	0.068	0.251	0	1
Skilled manual	0.646	0.478	0	1
Technical	0.039	0.193	0	1
Unskilled service	0.016	0.124	0	1
Skilled service	0.013	0.112	0	1
(Semi)professions	0.016	0.124	0	1
Unskilled commerc.	0.025	0.155	0	1
Skilled commerc.	0.129	0.336	0	1
Missing	0.032	0.176	0	1
Industry				
Agriculture	0.014	0.119	0	1
Energy/mining	0.025	0.157	0	1
Manufacturing	0.517	0.500	0	1
Construction	0.165	0.371	0	1
Trade	0.131	0.337	0	1
Transport/communic.	0.031	0.174	0	1
Financial intermed.	0.024	0.152	0	1
Other services	0.071	0.258	0	1
Non-profits	0.003	0.057	0	1
Public admin.	0.019	0.135	0	1
Cohort				
1977	0.343	0.475	0	1
1978	0.326	0.469	0	1
1979	0.332	0.471	0	1
Instrumental variable				
U_y	5.2	1.002	3.21	6.49
1987-1989 (N = 12,711)				

Adult wage	4.37	0.311	2.52	4.98
Youth employment	983	461	0	1,461
Age	19.47	1.65	15	29
Age squared	381	67	225	841
District UR	8.89	3.52	2.6	17.4
Adult UR	12.13	0.541	11.48	12.90
Delayed report	0.538	0.499	0	1
Firm wage	54.48	13.35	4.31	102.54
Firm size	1,070	4,800	1	62,825
Occupation				
Agricultural	0.019	0.136	0	1
Unskilled manual	0.092	0.290	0	1
Skilled manual	0.664	0.472	0	1
Technical	0.024	0.153	0	1
Unskilled service	0.018	0.134	0	1
Skilled service	0.012	0.108	0	1
(Semi)professions	0.010	0.101	0	1
Unskilled commerc.	0.028	0.164	0	1
Skilled commerc.	0.109	0.311	0	1
Missing	0.024	0.152	0	1
Industry				
Agriculture	0.015	0.120	0	1
Energy/mining	0.029	0.169	0	1
Manufacturing	0.512	0.500	0	1
Construction	0.150	0.357	0	1
Trade	0.111	0.315	0	1
Transport/communic.	0.047	0.211	0	1
Financial intermed.	0.019	0.136	0	1
Other services	0.082	0.274	0	1
Non-profits	0.009	0.094	0	1
Public admin.	0.026	0.160	0	1
Cohort				
1987	0.368	0.482	0	1
1988	0.333	0.471	0	1
1989	0.298	0.458	0	1
Instrumental variable				
U_y	7.95	1.05	6.57	9.72
1999-2001 (N = 8,359)				
Adult wage	4.23	0.443	2.50	4.99
Youth employment	875	530	0	1,461
Age	20.19	1.83	15	30
Age squared	411.14	76.41	225	900
District UR	8.48	2.71	2.6	16.7

Adult UR	13.22	0.751	12.42	14.79
Delayed report	0.095	0.293	0	1
Firm wage	79.33	20.36	1.97	146.24
Firm size	713	3,418	1	48,639
Occupation				
Agricultural	0.020	0.140	0	1
Unskilled manual	0.090	0.286	0	1
Skilled manual	0.603	0.489	0	1
Technical	0.031	0.173	0	1
Unskilled service	0.024	0.153	0	1
Skilled service	0.012	0.109	0	1
(Semi)professions	0.016	0.125	0	1
Unskilled commerc.	0.024	0.152	0	1
Skilled commerc.	0.142	0.349	0	1
Missing	0.039	0.193	0	1
Industry				
Agriculture	0.015	0.120	0	1
Energy/mining	0.017	0.127	0	1
Manufacturing	0.449	0.497	0	1
Construction	0.192	0.394	0	1
Trade	0.124	0.329	0	1
Transport/communic.	0.034	0.182	0	1
Financial intermed.	0.014	0.116	0	1
Other services	0.115	0.319	0	1
Non-profits	0.011	0.107	0	1
Public admin.	0.029	0.167	0	1
Cohort				
1999	0.329	0.470	0	1
2000	0.335	0.472	0	1
2001	0.336	0.472	0	1
Instrumental variable				
U_y	10.44	0.9736	9.24	12.33

TABLE VII

ADULT WAGE AND YOUTH EMPLOYMENT DISTRIBUTIONS BY GRADUATION PERIOD

	Adult wage (exp. year eight)									
Period/*percentile*	*5*	*10*	*15*	*20*	*25*	*30*	*35*	*40*	*45*	*50*
1977-1979	3.87	4.01	4.08	4.13	4.17	4.20	4.23	4.26	4.28	4.31
1987-1989	3.81	4.05	4.14	4.20	4.25	4.28	4.32	4.35	4.38	4.41
1999-2001	3.32	3.64	3.82	3.94	4.02	4.08	4.14	4.19	4.24	4.29
Period/*percentile*	*55*	*60*	*65*	*70*	*75*	*80*	*85*	*90*	*95*	*max*
1977-1979	4.34	4.36	4.39	4.43	4.46	4.50	4.55	4.62	4.72	4.93
1987-1989	4.43	4.46	4.49	4.52	4.55	4.59	4.64	4.70	4.78	4.98
1999-2001	4.32	4.37	4.41	4.46	4.51	4.57	4.64	4.72	4.82	4.99
	Youth employment (exp. years two to five)									
Period/*percentile*	*5*	*10*	*15*	*20*	*25*	*30*	*35*	*40*	*45*	*50*
1977-1979	18.4	243	425.2	608	725	818	911	975	1,004	1,006
1987-1989	0	151	338	547	716	852	965	1,017	1,089	1,096
1999-2001	0	0	93	211	353	500.6	642.7	787	915	1,034
Period/*percentile*	*55*	*60*	*65*	*70*	*75*	*80*	*85*	*90*	*95*	*max*
1977-1979	1,050	1,096	1,173	1,259	1,331	1,413	1,461	1,461	1,461	1,461
1987-1989	1,097	1,171	1,249	1,333	1,401	1,458	1,461	1,461	1,461	1,461
1999-2001	1,125	1,183	1,228	1,303	1,371	1,438	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 logarithm of the real daily wage in experience year eight. Youth employment is measured as the total number of days full-time employed subject to social security contributions between the second and the fifth experience year. The cohorts are pooled over the respective graduation period.

8.3. *Supplementary Figures*

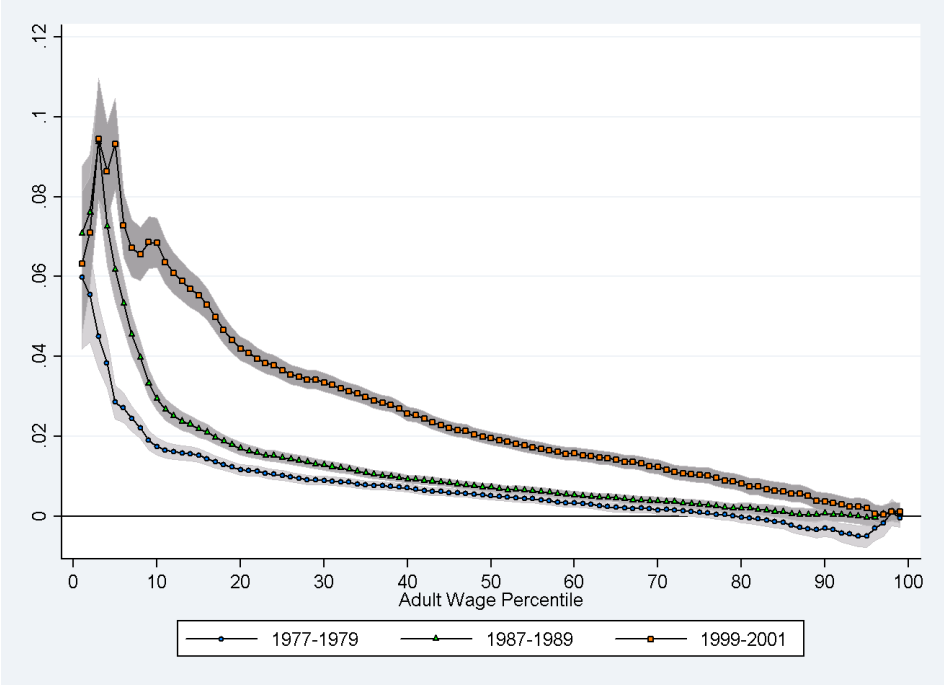

FIGURE 8.— Returns to Stability by Graduation Period at Adult Wage Percentiles (in %).

Notes: The figure plots the estimates of the returns to early-career employment stability from unconditional quantile regressions by graduation period. Shaded areas denote 95% confidence intervals, bootstrapped with 500 replications. The regressions are performed with Firpo, Fortin and Lemieux's (2009) recentered influence function estimator implemented in the Stata command *rifreg*. Model specifications are similar to those of columns (3), (6), and (9) of Table I. See the data appendix for definitions of variables.

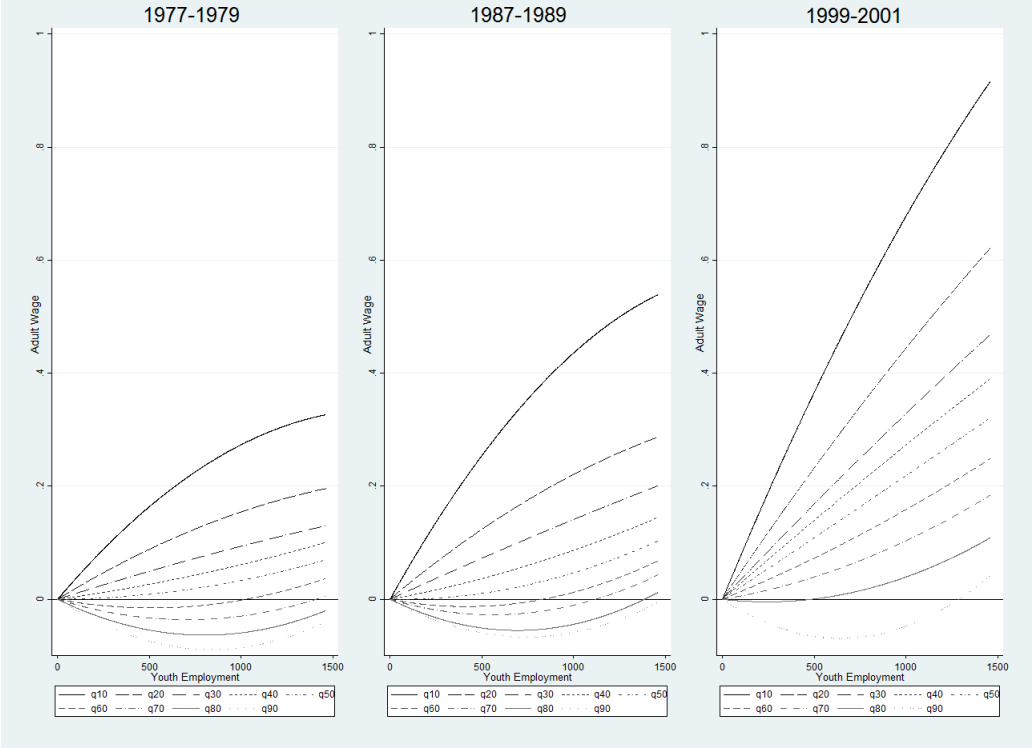

FIGURE 9.— Wage–Employment Profiles by Graduation Period.

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. Besides adding a squared term of early-career employment stability, the model specifications are similar to those of columns (3), (6), and (9) of Table I. The profiles are calculated while setting all the other coefficients of the model to zero. See the data appendix for definitions of variables.

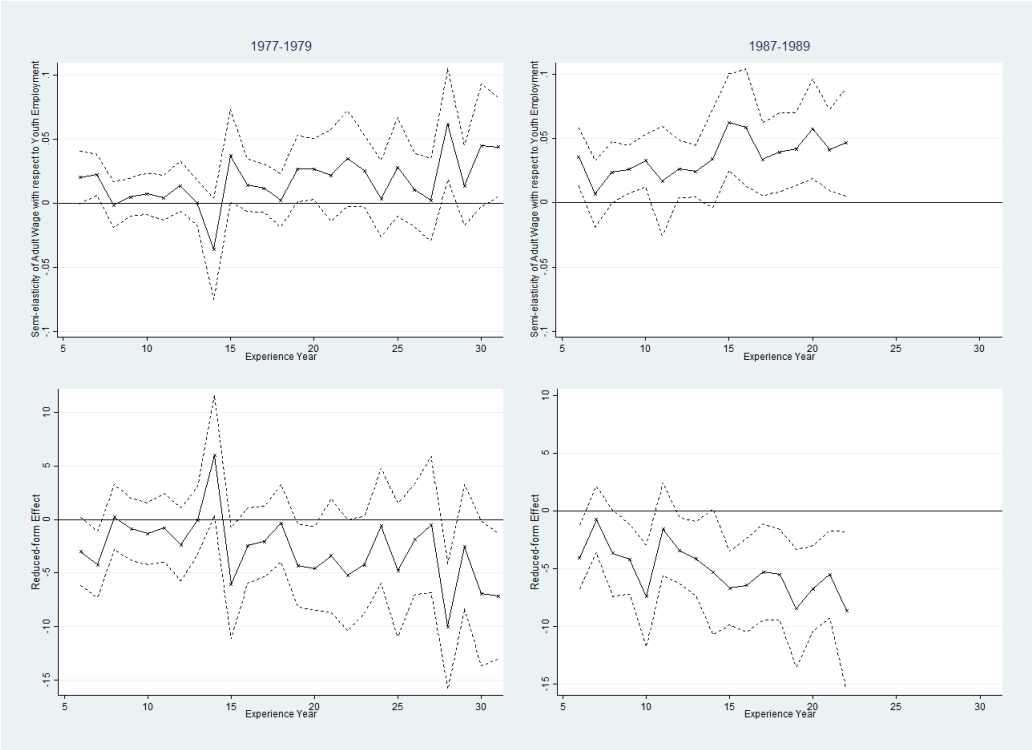

FIGURE 10.— Returns to Stability by Experience Year (in %).

Notes: The figure plots instrumental variable (IV) estimates of the returns to early-career employment stability at the mean of the wage distribution observed in a given experience year for the cohorts of apprentices graduating 1977 to 1979 (first column) or 1987 to 1989 (second column), respectively. The second stage effects are depicted in the first row, the corresponding reduced form effects are depicted in the second row. IV regressions are performed with Hansen, Heaton and Yaron's (1996) continuously-updated GMM estimator implemented in the Stata command *ivregress*; The instrument is the aggregate unemployment rate averaged over the second to fifth experience year (U_y). Apart from the instrument, variables included in the regressions of youth employment are the same as in the estimates of adult wage. Dashed lines indicate 95% robust confidence intervals. Model specifications are similar to those of columns (3) and (6) of Table I. See the data appendix for definitions of variables.