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**Conference Paper**

## Youth Employment Instability, True State Dependence and Adult Wage Inequality

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2013: Wettbewerbspolitik und Regulierung in einer globalen Wirtschaftsordnung - Session: Empirical Labor Economics, No. F18-V3

**Provided in Cooperation with:**

Verein für Socialpolitik / German Economic Association

*Suggested Citation:* Umkehrer, Matthias (2013) : Youth Employment Instability, True State Dependence and Adult Wage Inequality, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2013: Wettbewerbspolitik und Regulierung in einer globalen Wirtschaftsordnung - Session: Empirical Labor Economics, No. F18-V3, ZBW - Deutsche Zentralbibliothek für Wirtschaftswissenschaften, Leibniz-Informationszentrum Wirtschaft, Kiel und Hamburg

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YOUTH EMPLOYMENT INSTABILITY,  
TRUE STATE DEPENDENCE  
AND  
ADULT WAGE INEQUALITY

MATTHIAS UMKEHRER<sup>1</sup>

This paper examines recent trends in employment patterns on the labor market for youth and changing returns to early employment stability over the past four decades. True state dependence is identified by exploiting exogenous variation in early-career work experience induced by differences in the time already spent on the labor market when a recession occurs. The results indicate decreasing employment stability for youth since the late 1980s limited to the lower half of the employment distribution. Economic returns to early employment stability are estimated to be both statistically and economically significant: While one additional day of youth employment increases adult wages on average by 0.034% for cohorts graduating in the late 1980s, this effect has almost doubled to 0.066% for cohorts graduating in the late 1990s. Furthermore, instrumental variable quantile regressions reveal this impact to be mostly pronounced at the bottom of the adult wage distribution. Comparison of quantile treatment effects suggest that changing patterns of this kind of true state dependence contribute to rising wage inequality in the lower tail of the adult wage distribution.

KEYWORDS: employment stability, true state dependence, wage inequality, quantile regressions

JEL-CLASSIFICATION: C20, J21, J31.

1. INTRODUCTION

As in almost all developed economies, the German labor market has undergone considerable structural change over the past four decades.<sup>1</sup> This essentially affected both the structure of wages and employment. The most frequently discussed phenomenon is certainly the remarkable increase of wage inequality especially pronounced since the late 1980s [cf. [Dustmann, Ludsteck and Schönberg \(2009\)](#)].<sup>2</sup> [Card, Kline and Heining \(2012\)](#) describe three major trends contributing to this process: Besides rising heterogeneity between workers as well as between the wage premia paid by firms, they document a rising assortativeness between high paying employers and high earning employees.

Almost during the same period, several reforms aimed at reducing employment protection in order to increase labor market flexibility were adopted and

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<sup>1</sup>An overview on the main macro trends and institutional changes during that time period is given by [Card, Kline and Heining \(2012\)](#)

<sup>2</sup>This development can be observed in almost all industrialized countries, see [Acemoglu and Autor \(2011\)](#) for an overview.

then partly revoked after the turn of the century. Mainly legislations regarding fixed-term contracts, temporary work and dismissal protection were concerned. In interaction with the recent economic challenges provided by ongoing globalization, rapid technological change and prevailing demographical change, this might to a large extent explain the empirical finding of decreasing employment continuity primarily for youths and women since the late 1980s in Germany but also in many other European countries and the U.S. [cf. [Monks and Pizer \(1998\)](#); [Bernhardt, Morris, Handcock and Scott \(1999\)](#); [OECD \(1999\)](#); [Neumark \(2000\)](#); [Auer and Cazes \(2002\)](#)].<sup>3</sup>

Because "a rising share of wage inequality is attributable to variation in the job opportunities available to a given worker," this "raise[s] a number of questions regarding [...] the process by which workers are matched with employers" [Card, Kline and Heining \(2012, p. 6\)](#). Since the process of career development decisively depends on the first years of the professional history [cf. [Topel and Ward \(1992\)](#); [Oreopoulos, von Wachter and Heisz \(2012\)](#)], changing patterns of state dependence between early labor market experiences and adult labor market outcomes suggest a further explanation for the observed changes in Germany's wage structure. This is exactly what is examined in this paper.

More specifically, this paper explains wages of prime-aged men by early employment stability. For this purpose, we match the Sample of Integrated Labour Market Biographies (SIAB) with the Establishment History Panel (BHP). The resulting data set is administrative matched employer-employee data containing a random sample of the universe of social security records in Germany. In order to form a quite homogenous sample but to maintain representativeness, this paper focusses on males of German nationality entering the West German labor market through the dual education system (see [Section 8.1](#) for further details on data selection and cleansing). Eleven labor market entry cohorts graduating in three different entry periods [1977-1980; 1987-1990; 1998-2000] are investigated.

In a first step, we explore differences in employment patterns on the labor market for youth. In a second step, we examine whether there are returns to early employment stability and how these have altered between graduation periods. In a third step, we investigate the role of changing labor market patterns for youths in contributing to rising wage inequality in adulthood. With regard to wage inequality, three questions are of subject: First, at a given duration, have the returns to employment stability changed over time? Second, holding returns constant, does decreasing employment stability in youth contribute to rising wage inequality in adulthood? Third, to which extent is the increasing variation in wages attributable to this type of state dependence?

In light of rapid technological change and intensified competition due to ongoing internationalization, increasing *costs* of joblessness over time might well be expected. The most common explanations might be accelerated depreciation

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<sup>3</sup>While Germany escaped the current boost of youth unemployment experienced by numerous European countries and the U.S., unemployment rates of workers aged below 24 increased in Germany from 5.8% (1991) to 8.4% (2001) to 8.6% (2011), see [Eurostat \(2013\)](#).

of human capital [cf. [Pissarides \(1992\)](#)] and/or amplified interference of signals perceived by perspective employers [cf. [Gibbons and Katz \(1991\)](#)]. If those impact asymmetrically on certain groups of workers located at different positions in the adult wage distribution rising variability in wages would emerge.

The main findings of this paper are as follows: Descriptive evidence shows that the distribution of (cumulated) early employment duration has not changed over time for a large part of the sample. Remarkably, duration has become more unequal only because of short employment periods becoming shorter and shorter, especially observable since the late 1980s. Job security, measured as indirect job mobility, however has hardly changed over the sample period. Consistent with the hypothesizing above, we find the returns to early employment stability in terms of adult wages between the late 1980s and late 1990s to have almost doubled: While one additional day of youth employment increases adult wages on average by 0.034% for cohorts graduating in the late 1980s this effect has increased to 0.066% for cohorts graduating in the late 1990s, *ceteris paribus*. Quantile instrumental variable regressions reveal this impact to be especially pronounced at the bottom of the wage distribution and much weaker at the top. Comparison of quantile treatment effects suggest that changing patterns of this type of true state dependence contribute to rising wage inequality since the 1980s in the lower tail of the wage distribution.

In order to identify structural state dependence, an instrumental variable (IV) strategy was developed. The idea is to utilize within-cohort variation in early-career work experience induced by differences in the time already spent on the labor market when a recession occurs. Concretely, early employment stability is instrumented with aggregate labor market conditions prevailing in a certain year since graduation. Matching aggregate unemployment rates on a daily level allows to simultaneously control for cohort fixed-effects.

We consider the instrument to be relevant, independently assigned and excluded. First, we consider it to be relevant because establishing a stable employer-employee match should be easier when economic conditions are favorable. Second, we assume the instrument to be independently assigned because individuals are only unlikely to choose their year of graduation with regard to future economic conditions according to both their motivation to work and their potential to earn. To minimize this possibility we also control for a rich set of initial conditions and cohort fixed-effects. Furthermore, no cohort is chosen to enter into a recession directly, which to a great extent rules out anticipation effects. Finally, the instrument presumably impacts on adult wages only indirectly through reducing early-career employment stability. On the one hand, wages are measured at least eight years after graduation. So, there is plenty of time to adjust in any other matters than forgone work experience. On the other hand, everybody suffers through a recession at some point in their early career. Therefore every individual lives through the same economic and institutional changes entailed by a recession. To control for any remaining persistence in aggregate labor market conditions, unemployment rates prevailing at the time of wage measurement are

also controlled for [cf. [Gregg \(2001\)](#)]. Although the returns to employment stability turn out to be somewhat larger for IV than for OLS estimates, the basic conclusions of the paper do not depend on the estimation technique.

This paper contributes to the economic literature in at least three ways: First, it contributes to the literature on persistent effects of early labor market conditions in general and to the literature on scarring effects in particular. The former for example confirms long-lived earning losses associated with graduating from college during a recession [cf. [Oreopoulos, von Wachter and Heisz \(2012\)](#)] or with an early career job loss, cf. [von Wachter and Bender \(2006\)](#). The latter is partly surveyed in [Ryan \(2001\)](#) and largely concerned with unemployment. Recent work for example confirms significant scarring effects of youth unemployment on adult unemployment and/or adult wages in many countries, see for example [Schmillen and Umkehrer \(2013\)](#) for Germany, [Gregg \(2001\)](#) and [Gregg and Tominey \(2005\)](#) for the U.K., [Mroz and Savage \(2006\)](#) for the U.S. and [Nordström Skans \(2011\)](#) for Norway. Closely related to our study is the work by [Neumark \(2002\)](#) who finds significant and substantial positive effects of early job stability on adult wages for the U.S..

Second, it further adds to the literature on changing employment patterns, see for example the overview provided by [Neumark \(2000\)](#) for the U.S. and [OECD \(1999\)](#) or [Auer and Cazes \(2002\)](#) for Europe. The study by [Bernhardt, Morris, Handcock and Scott \(1999\)](#) is particularly interesting because it focuses on young white men and compares wage returns of early job changes between cohorts. Their results suggest increasing job instability, declining returns to job changing and rising inequality in these returns on the U.S. youth labor market.

Third, a link to the broad literature on wage inequality is established by suggesting changing patterns of true state dependence between youth employment and adult wages as a source of rising wage inequality. This is motivated by the finding of [Card, Kline and Heining \(2012\)](#) who describe a raising assortativeness between high paying employers and high earning employees as an important source of rising wage variability in Germany. This might to a certain extent be driven by lacking work experience increasingly preventing upward job mobility for a certain group of workers.

From a policy point of view, the results suggest that smoothing the training-to-work transition should affect both the location as well as the skewness of the wage distribution. I.e. matching new entrants and well suited jobs as soon and efficient as possible has the potential to raise adult wages and decrease future wage inequality. Since the development of both wages and employment exhibits similar patterns in many industrialized countries these findings are likely to be of relevance for other developed economies as well.<sup>4</sup>

The paper proceeds as follows: Section 2 contains theoretical considerations, Section 3 describes the data set, Section 4 provides descriptive evidence and Sec-

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<sup>4</sup>[Ryan \(2001\)](#) argues that an mechanism such as true state dependence is too economically fundamental to be only nationally specific.

tion 5 outlines the identification strategy. Section 6 provides mean and quantile regression estimates of the returns to early employment stability and Section 7 concludes.

## 2. THEORETICAL CONSIDERATIONS

This section starts with a discussion on potential reasons for relative employment losses among young workers. Natural explanations are provided by recent trends underlying both the supply and the demand for tasks of a certain specificity interacting with adjustments of the institutional setting. These explanations comprise (i) technological progress, (ii) internationalization, (iii) institutional change, (iv) changes in the employment relationship and (v) demographical change. With regard to technological progress, increasing substitutability of certain tasks with capital might both reduce the demand for workers supplying these tasks and enhance demand for specific skills that are complementary to capital [cf. [Acemoglu and Autor \(2011\)](#)]. On the contrary, rising incentives for educational investment might induce shifts in educational attainment and towards more advanced vocational training after graduation. If these adjustments are imperfect, however, workers offering routine manual and routine cognitive tasks loose employment prospects relative to workers exhibiting nonroutine cognitive tasks, see [Autor, Levy and Murnane \(2003\)](#). A second potential explanation for relative employment losses for a certain group of young workers is increased competition on the labor market for youth induced by ongoing internationalization. [Smith \(2012\)](#) demonstrates immigration of less skilled workers to impact considerably more on the employment outcomes for native youths than for native adults. This is on the one hand because young native labor substitutes more easily for immigrated labor and on the other hand because youth respond more frequently to immigration-induced wage changes. Third, during the mid-1980s to late 1990s, a variety of reforms aimed at reducing employment protection in order to increase labor market flexibility were adopted. However, most of these regulations have been withdrawn by the reforms of 1999 and 2001.<sup>5</sup> In general, according to the [OECD \(1999\)](#), Germany exhibits a high degree of employment protection relative to most other European countries. With regard to employment stability, [Pissarides \(2001\)](#) discusses stricter employment protection legislation to prolong both duration of employment and unemployment by reducing employment terminations and job creation. If young workers benefit less from employment protection because of insufficiently long job tenures, shifts are in favor of prime-aged men and at the expense of youths. Fourth, alternative forms of employment besides full-time work are increasingly gaining importance. For example, [Levenson \(2000\)](#) finds the rate of involuntary part-time employment as well as of temporary work to have grown in the U.S. since the 1970s particularly for young and low-skilled men and women. [Houseman](#)

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<sup>5</sup>See [Giannelli, Jaenichen and Villosio \(2012\)](#) for an overview of labor market regulations concerning employment protection in Germany.

and Polivka (2000) show jobs of these types to be less stable and secure. Flexible staffing arrangements have also become more common since the mid-1980s and might contribute to lower employment stability for youth. Furthermore, ongoing globalization has intensified competition on the product market. This might have evoked employers' needs for re-organization and management restructuring towards a more efficient organization of the employment structure. Employers might therefore choose their workforce more thoroughly and seek to realize rationalization potentials by e.g. the progressive use of outsourcing and/or offshoring. Finally, demographical change is mainly reflected in declining birth-rates. At first glance, if labor supply declines faster than labor demand, this development might counteract raising employment instability in future decades.

Declining employment stability early in professional life does not necessarily imply adverse effects for future career progression. On the one hand, the first years on the labor market are characterized by rapid wage growth and a high degree of job mobility [cf. Mincer (1974); Topel and Ward (1992)].<sup>6</sup> Therefore they are often viewed as an adjustment process leading over to stable employer-employee relationships. Hence it might be argued that early employment instability is only of concern for the individual's career development if negative shocks cannot be overcome by means of rapid adjustment. On the other hand, there is also evidence that young workers are particularly exposed to demand shocks and changing economic conditions [cf. Farber (1993); Blanchflower and Oswald (1994); Smith (2012)]. Therefore it remains an empirical question whether there are positive returns to early employment stability at all.

The main theoretical argument for why early labor market experiences should indeed have long-lasting consequences is *true state dependence*, as defined by Heckman and Borjas (1980).<sup>7</sup> Within this framework the most dominant explanations for a causal link between early employment stability and adult wage outcomes are lacking accumulation of human capital during periods of joblessness [cf. Pissarides (1992); Acemoglu (1995)] and/or stigma effects [cf. Gibbons and Katz (1991)]. Since the previous employment history is one of the most important criteria used by employers to screen applicants, see Blanchard and Diamond (1994) or Atkinson (1996), the job opportunities available to a given worker in a more established phase of the career should decisively depend on the employment patterns experienced early in professional life.

But why should the returns to early-career employment stability have changed considering two identical career trajectories at different points in time? One potential explanation is accelerated depreciation of human capital. Goos, Manning and Salomons (2009) find the occupational structure in Germany as well as many other European countries to polarize in a sense that employment shares of both

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<sup>6</sup>These patterns are quite similar between the German youth labor market and the labor market for youth in the U.S., cf. von Wachter and Bender (2006).

<sup>7</sup>In case of *true state dependence*, either preferences, prices or constraints which determine future labor market performance are altered by crucial events in the professional history, see Heckman and Borjas (1980) for a formal definition.

high-skill and low-skill occupations increase relative to occupations in the middle of the skill distribution. Altonji, Bharadwaj and Lange (2012) show that the current generation of young workers is also more skilled than former ones. This might be explained by technological progress replacing demand for routinized tasks [cf. Autor, Levy and Murnane (1991)] and thereby inducing shifts in labor supply. It is reasonable to assume that this kind of non-routinized human capital depreciates faster - not only in absolute terms but also relative to otherwise identical individuals continuously accumulating such skills - and/or is harder to acquire than skills required to perform automatable tasks. Moreover, if labor market competition increases predominantly for low-skill workers, loss of skill relative to otherwise identical but continuously employed individuals would become more severe for workers who are of low ability than for high-skill workers. If alternative forms of employment, like marginal employment during periods of benefit receipt, prevent the deterioration of human capital while searching for a stable job [cf. Caliendo, Künn and Uhlenhorff (2012)], the returns to early employment stability might as well decline.

Irrespective of employment duration, however, returns to early employment stability might have changed over time because of changes in the hiring process or the job search behavior. Autor (2009) discusses the role of rising labor market intermediation in decreasing the costs of information available to both sides of the labor market. From the employers' perspective, technological and institutional change, changes in the employment relationship and intensified competition on the product market might both ease and increase the importance of screening applicants. Early interruption of the employment process might therefore increasingly damage career prospects, irrespective of the true level of productivity. From the perspective of job seekers, increasing transparency might render search more efficient and therefore contributed to the formation of productive matches. Dissolving such a productive match might have more severe consequences for the individual compared to a separation from a less attractive job.

Finally, increasing returns to early employment stability provide an explanation for rising wage inequality only if changes impact asymmetrically on workers characterized by a certain position in the distribution of adult wages. For this to be the case it is sufficient if either the duration of employment (holding returns constant) or the returns (holding duration constant) change in different ways for different groups of workers. Most of the structural changes on the labor market discussed above are discussed by the literature as providing major explanations for raising wage inequality as well. If for example relative *supply* of low-skill labor increases, periods between employment spells would prolong if it is increasingly becoming harder to find a suitable job once displaced. If relative *demand* for high-skill labor increases and supply adjustments are imperfect, consequences of instable early employment histories might be more forgiving for the group of high-skill workers. All in all it remains an empirical question whether there are returns to early employment stability, how these are altered by changing employment patterns and whether wage inequality is influenced by this process.



## 3. DATA

The empirical analysis of this paper is 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 sources are edited and merged in the Integrated Employment Biographies (IEB). The IEB therefore contain comprehensive information on complete labor market histories and demographic characteristics depicted exact to the day. About 80% of the total German workforce is covered [cf. [Oberschachtsiek, Scioch, Seysen and Heining \(2009\)](#)]. The SIAB finally is a 2% 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<sup>th</sup>, is also merged with the SIAB.<sup>8</sup> For a detailed description of the BHP see [Hethey-Maier and Seth \(2010\)](#) and for the SIAB see [Dorner, Heining, Jacobebbinghaus and Seth \(2010\)](#).

The basic sample selection restricts the empirical analysis to males of German nationality who graduated in Western Germany from the Dual Education System.<sup>9</sup> All individuals who exhibit a high school diploma at this point of the professional career are excluded as well. This on the one hand forms a quite homogenous sample with regard to former labor market experience, professional background and future expectations. On the other hand, about 60% of all individuals who enter the German labor market each year go through this system. Therefore the chosen sample is still representative for a major proportion of the German workforce. [Mincer \(1962\)](#) characterizes the period of schooling prior to an apprenticeship as a preparatory stage. The occupational skills conveyed during training are also meant to be unspecific to a certain extent. This renders graduation from the dual education system an ideal starting point for our analysis of consequences of early labor market shocks [see also the discussion in [von Wachter and Bender \(2006\)](#)].

To solve the identification problem between age-, cohort- and time-effects described in [Fitzenberger, Hujer, MaCurdy and Schnabel \(2001\)](#), individuals are classified into cohorts by their calendar year of graduation. The exact day of labor market entry is identified by the end of the first training period recorded. Cohorts graduating within three distinct and relatively short time intervals are compared in order to examine how the returns to early employment stability

<sup>8</sup>The SIAB data replaces the IAB Employment Sample (IABS) as well as the Integrated Employment Biographies Sample (IEBS).

<sup>9</sup>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.

have changed. Specifically the periods 1977-1980, 1987-1990 and 1998-2000 are chosen.<sup>10</sup> The key regressor is employment stability experienced early in the professional career. We construct a cumulative measure adding up all days spent full-time employed during the period between the *second* and the *fifth* employment year. The data structure provides at least three additional advantages as compared to the measures usually available in many other data sets. First, the daily depiction allows for an exact timing of the period of measurement. Second, restriction to full-time employment ensures consistency of our measure over time and between cohorts. Lacking time-consistency of such measures is often considered a serious problem of many studies on the subject of employment stability [cf. [Stuart \(2002\)](#)]. Third, informative value of employment patterns during the initial employment year is only limited with regard to early-career employment stability and should only cautiously be compared between individuals, for example because of military service and initial job search blurring the overall picture of stability. The data structure also allows to discard this information properly.

The dependent variable of interest is the wage level achieved in a more established phase of the professional history, i.e. when the early adjustment process discussed above has settled. The primary measure chosen is the log of the average real daily wage from dependent employment in the *eighth* employment year. Wages are deflated using the CPI provided by the German Federal Reserve, cf. [Deutsche Bundesbank \(2012\)](#). If there are multiple employment spells recorded in that year, wages are averaged using the duration of the corresponding spell as weight. The critical choice is on the time-gap of measurement between the two main variables. For the baseline specification a three year window is chosen which will be expanded in the robustness section afterwards.

The SIAB provides a rich set of control variables observable at time of graduation. Measuring control variables at graduation has two advantages: First, differences in initial conditions at labor market entry which might impact on both early employment and future wages can be controlled for. Second, interpretability of results is ensured because controls are not themselves determined by the main regressor, youth employment stability. Control variables extracted from the last training spell are: 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 trained and dummy variables for the cohort. For reasons outlined in [Section 5](#), the aggregate unemployment rate in the eighth year on the labor market is the only control variable measured after labor market entry.<sup>11</sup>

The following two sections will characterize the distributions of youth employ-

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<sup>10</sup>This design of multiple cohorts within a period allows to control for cohort fixed-effects and at the same time to exploit variation in early employment patterns between cohorts induced by changing aggregate labor market conditions. See [Section 5](#) for details on this identification strategy.

<sup>11</sup>See the [Section 8.1](#) for further details on data cleansing, sample selection and variable definitions.

ment and adult wages. Changes between and within cohorts will be analyzed descriptively and the empirical strategy for identification of true state dependence between the main variables will be addressed in detail.

#### 4. DESCRIPTIVE EVIDENCE

Comparing the distributions of adult wages between cohorts entering the labor market in the period 1977-1980 and cohorts graduating 1998-2000 reveals an increase of the inter-quartile range from 0.29 (1977-1980) to 0.46 (1998-2000) log points. This increasing wage inequality is examined in more detail by Figure 1. Depicted is the difference in log-wage percentiles between the distributions in the respective time intervals. For sake of comparability, relative percentile changes are indexed to the change of the median. Comparison of the wage distribution of entrants from the late 1970s with the wage distribution of entrants from the late 1980s reveals no remarkable difference between percentiles above the median. But there is some decline in the lower half of the wage distribution which becomes mainly visible at the 10<sup>th</sup> and the 5<sup>th</sup> percentile. However, the overall picture suggests that the shape of the wage distribution has remained fairly stable during that period. In contrast, adult wage inequality for the cohorts entering the labor market in the years 1998-2000 relative to those individuals starting their careers in the late 1980s has increased from both the top and the bottom of the distribution. This is consistent with what was found for Germany before by [Dustmann, Ludsteck and Schönberg \(2009\)](#) or [Card, Kline and Heining \(2012\)](#). Finally, contrasting the wage distribution of cohorts from the late 1970s with cohorts from the late 1990s confirms that the increase of wage inequality above the median took exclusively place since the late 1980s while wage inequality in the lower tail of the distribution started to increase already from the late 1970s on.

A similar picture is drawn by Figure 2, but now for the distributions of youth employment stability instead of adult wages. Figure 2 shows the relative change of percentiles between distributions of early employment duration for respective time intervals. Again, for cohorts entering in the late 1970s and cohorts graduating in the late 1980s youth employment has remained fairly stable. Quite similar to what was observed for the distributions of adult wages, only durations below the 30<sup>th</sup> percentile are beginning to shorten while durations of medium length even slightly prolong. The development between the late 1980s and the late 1990s however shows a considerable decline of percentiles below the 60<sup>th</sup> percentile. Over all three time intervals, the lower quartile drops from 476 days (1977-1980) to 443 days (1987-1990) to 273 days (1998-2000) and the lowest decile drops from 26 days to 17 days to zero days. Furthermore, it again becomes apparent that most of the distributional changes took place since the late 1980s. While the number of days employed during early-career for youth starting their professional life around the turn of the century dramatically declined for about half of the sample, employment durations for the upper fifty percent have

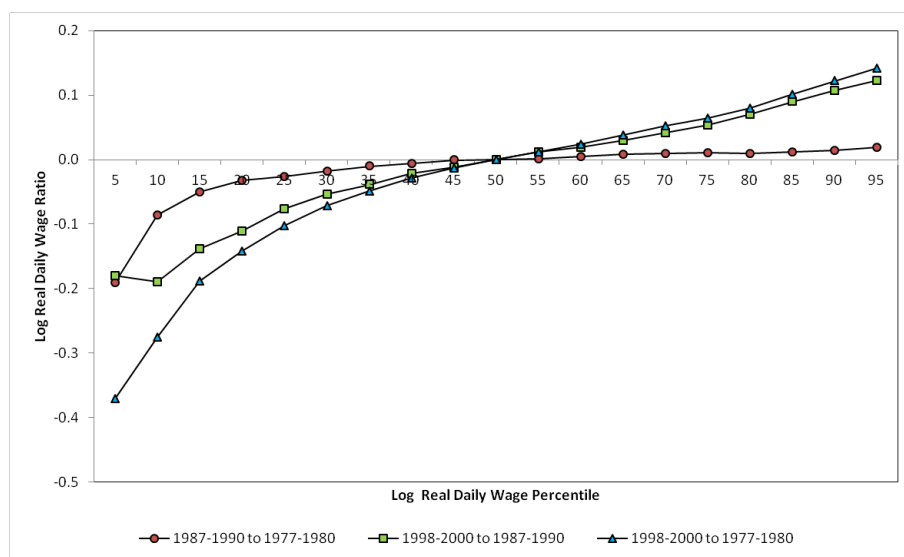


FIGURE 1.— Comparison of adult wage distributions between periods of labor market entry.

Notes: Log of real daily wages measured during the eighth year on the labor market. Labor market entry cohorts pooled by time intervals. Relative percentile changes indexed to the change of the median.

not declined at all or have even slightly increased. The proportion of individuals continuously employed during the whole four-year period remained also constant at about 15% over the observation period.

Another important dimension next to employment stability is job security. Although not directly in the focus of this paper it is worth having a look at the inter-temporal patterns of job mobility. We distinguish between two forms of job mobility: direct and indirect changes of employer. With direct changes of employer being defined as the occurrence of a separation followed by reemployment at a new employer within less than three weeks they are likely to reflect voluntary job changes. In contrast, indirect changes are defined as changes with an interruption of employment lasting longer than three weeks and the worker not being recalled by his/her former employer. Comparing cohorts entering the labor market in the three time intervals 1977-1980, 1987-1990 and 1998-2000 shows no substantial change in neither direct nor indirect job mobility: The proportion of individuals who experience at least one direct change of employer is on average 39% (1977-1980), 43% (1987-1990) and 42% (1998-2000). The probability to experience at least one indirect change of employer is higher but stays almost constant between cohorts as well, specifically 63% (1977-1980), 58% (1987-1990) and 63% (1998-2000). One possible explanation for declining employment stabil-

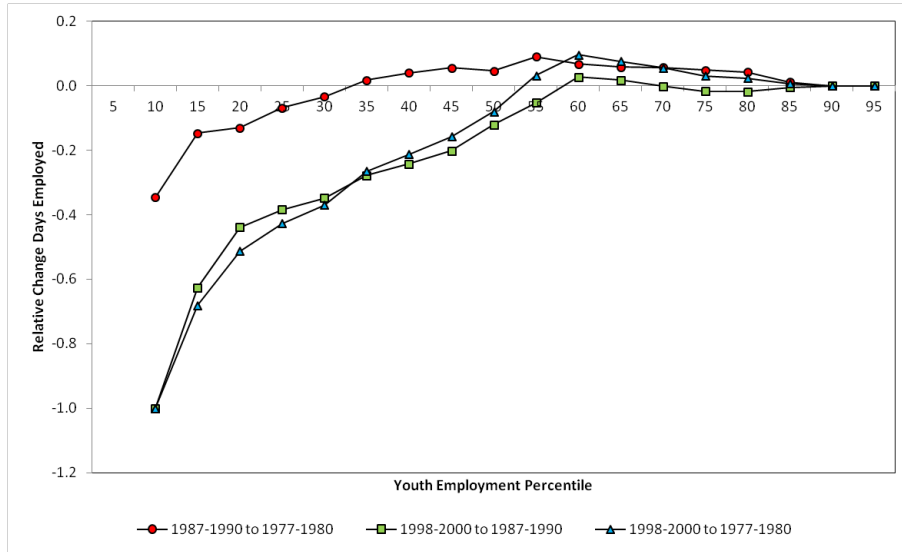


FIGURE 2.— Comparison of employment stability distributions between periods of labor market entry.

Notes: Employment stability measured as the total number of days full-time employed subject to social security contributions between the second and the fifth year on the labor market. Labor market entry cohorts pooled by time intervals.

ity accompanied by time-constant job security, measured as indirect job mobility, is that existing bounds between employers and employees have at least not weakened over time while it is increasingly becoming harder for youths to establish such longer-termed relationships. [Pissarides \(2001\)](#) for example discusses the role of employment protection in lowering the inflows into and outflows out of both employment and unemployment by reducing employment terminations and job creation. If young workers benefit less from employment protection because of insufficiently long job tenures, shifts are in favor of prime-aged men and at the expense of youths.

Still it is important to emphasize that the shortening of already relatively short employment durations itself does *a priori* not imply adverse effects for individual career progression. If this development for example reflects positive trends in further educational achievement and if these returns outweigh the costs of lacking work experience, impact on future wages might as well be positive. However, the probability of spending at least one day non-employed, modeled on the definition by [Fitzenberger and Wilke \(2010\)](#), has steadily increased since the German reunification and has arrived at its maximum of 69% in the recession of 2002.<sup>12</sup> This suggests that a certain proportion of the decreasing employment

<sup>12</sup>As a comparison, the non-employment probability in 1983 was 58% and therefore more

durations reported above is linked to unemployment and probably not chose voluntarily. The questions whether lacking work experience really hurts and whether the described distributional changes in early-career employment stability truly contribute to increasing wage inequality can only be answered in a multivariate framework. The empirical strategy pursued to control for endogenous influences which might blur the possible existence of true state dependence is described in the next section.

## 5. IDENTIFICATION STRATEGY

A regression of adult wages on early employment stability imposes one major challenge: Serially correlated patterns of unobserved heterogeneity, which impacts on both wages and employment duration, might induce correlation between the two variables irrespective of the existence of true state dependence [cf. Heckman and Borjas (1980)].<sup>13</sup> However, conclusions drawn for policy advice crucially hinge on the existence of true state dependence. Without such a structural link it would not (eventually) be possible to alter future labor market outcomes by manipulating labor market outcomes today.

Unobserved individual ability biasing estimates of the returns to early employment stability upwards is a first potential source of bias. However, previous work by Gardecki and Neumark (1998) finds only little evidence for effects of early job stability on adult labor market outcomes in models where unobserved heterogeneity is probably not fully controlled for. This suggests that overall bias in regression models that do not sufficiently account for confounding factors is, if anything, negative. Besides classical measurement error inducing attenuation bias, economic theory provides good reasons for unobserved heterogeneity biasing estimates of the returns to employment stability downward instead of upward. The creation of a control group which appropriately reflects the counterfactual situation a group of individuals would be faced with if they did not experience the exogenous treatment of involuntary employment interruption requires to control for all remaining differences in early-career employment patterns that have a persistent impact on adult wages. Such patterns are for example systematic differences in (i) the probability to participate in advanced vocational training, (ii) the job search behavior and (iii) the returns to search. First, if individuals with a high earning potential decide to continue professional education after graduation more frequently instead of holding a full-time job, a negative correlation between

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than ten percentage points smaller during the severe recession following the second oil price shock of 1981.

<sup>13</sup>Censoring and selection into employment constitute potential problems as well. Since this study focuses on individuals graduating from the dual education system wages are relatively low in general and censoring is of minor importance. However, for about 20% (1987-1990) and 26% (1998-2000) of all graduates no wages are observable in the eighth employment year. This probably constitutes a negative selection and the estimates of the returns to early employment stability neglecting selection into employment reported in this paper might be interpreted as lower bounds.

further education and early employment duration would interact with a positive correlation between further education and future wages and thereby introduce downward bias in the returns to early employment stability.<sup>14</sup>

Second, non-random differences in the search strategy for better jobs might as well decrease employment duration but lead to higher wages in the long run. [Levenson \(2000\)](#) provides evidence that alternative employment forms are to a certain extent part of an optimal search strategy and often used to prevent the negative signals transferred by periods of unemployment. Part-time and temporary work are also frequently used by job losers as bridges into better paying jobs [cf. [Farber \(2000\)](#)]. Furthermore, there is evidence that employers make use of temporary work agencies as a screening device [cf. [Houseman and Polivka \(2000\)](#)]. A generous benefit system generally tends to facilitate such mechanisms of prolonged search [cf. [Tatsiramos \(2006\)](#)]. Failing to control for these factors in a regression of adult wages on early employment stability might contribute to an underestimation of the true returns if a prolonged period of job search is non-randomly chosen in order to increase adult wages later in professional life.

Finally, [Neumark \(2002\)](#) extensively discusses the identification problem in case of the returns to early job stability. He reaches the conclusion that the returns to stability tend to be *understated* in models where unobserved factors are not sufficiently controlled for. Drawing on a stylized version of a model of job search and job shopping by [Mortensen \(1986\)](#), [Neumark \(2002\)](#) suggests as a theoretical explanation unobserved heterogeneity in productivity or the returns to search to generate negative correlation between early job stability and adult wages. Or more intuitively, “although there are returns to search, there are also positive returns to early job stability” [[Neumark \(2002, p. 463\)](#)].<sup>15</sup>

The approach taken in this paper in order to identify the causal effect of early employment stability on adult wages is to exploit variation in early labor market conditions induced by the severe recessions of the periods 1991-1994 and 2001-2003, respectively. Because the descriptive evidence provided in [Section 4](#) shows that most of the shifts in the distributions of both wages and employment has taken place since the late 1980s, only cohorts entering in the period 1987-1990 are compared with those entering in 1998-2000. Time intervals are chosen so that no cohort enters into a recession directly, but each of the cohorts does so at some point in time. Yet, we argue that the time already spent on the labor market when the recession comes into play is a determining factor of the employment stability experienced. This is simply because establishing a stable employer-employee match should be easier when economic conditions are favor-

<sup>14</sup>The probability to achieve a high school diploma within ten years after graduation has increased from 24% (1980) to 36% (1990) to 43% (1996) in our sample. Advanced vocational training therefore provides a consistent explanation for downward bias only if the downward bias increases over time. This is exactly what is observed in [Section 6](#).

<sup>15</sup>Although employment stability is in the focus of this paper, the reasoning of [Neumark \(2002\)](#) applies here too. In case of job stability, however, downward bias in OLS estimates should be larger if heterogenous returns to search provide an consistent explanation. This will be tested later on.

able. This variation is used to identify the effects of interest *within* the intervals 1991-1994 and 2001-2003 separately. Furthermore, because this kind of variation should also be widely comparable over time, a comparison *between* the two time intervals allows to evaluate both wage-structure as well as composition effects.

The identification strategy is illustrated in Figure 3 and Figure 4. Figure 3 plots the average number of days employed by cohort and year on the labor market. Consistent with the view that the first years on the labor market constitute an adjustment process, the average employment duration within each cohort concavely increases from the second year on and settles down after about eight to ten years. Three aspects are worth further emphasizing: First, employment duration in adulthood is on average longer for all the cohorts graduating 1987-1990 compared to those cohorts starting their career 1998-2000 (by on average 20 days in the eighth year). Second, those cohorts who enter the labor market closest to the recessions of 1991-1994 or 2001-2003, respectively, are doing considerably worse in terms of shorter annual employment duration compared to cohorts entering earlier. This is indicated by the horizontal line linking observations of the fifth year on the labor market. Third, although a catch-up process becomes visible, these differences in average annual duration persist all over the observation period. All in all, the picture drawn by Figure 3 is consistent with unfavorable labor market conditions lowering employment durations depending on the time already spent on the labor market. This provides the first stage of our estimation approach.

The picture drawn by Figure 4 is quite similar to that of Figure 3.<sup>16</sup> Now, average wages by cohort are plotted against year on the labor market. Again, the early adjustment process becomes visible. Maybe surprisingly, the growth-paths of wages for cohorts graduating in the late 1990s are far more linear than they have been in the mid-1980s. Still we observe wages in the eighth year, indicated by the horizontal line, for cohorts graduating closer to the corresponding recessionary years, which are shaded in grey, being considerably lower than the average annual wages of cohorts entering earlier. The differences also seem to persist throughout the major part of the observation period. Figure 4 therefore suggests that graduating closer to a recession has also an impact on adult wages. This provides the reduced form of our estimation approach.<sup>17</sup>

In order to implement the procedure described above, we calculate aggregate unemployment rates  $U$  on a *daily* level from the SIAB's full sample and merge them with the individual employment histories of the selected sample. In a second step, a measure on an annual level that still varies by day of graduation is

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<sup>16</sup>It is also surprisingly similar to the earnings-experience profiles of Canadian college graduates depicted by Figure 1A in Oreopoulos, von Wachter and Heisz (2012).

<sup>17</sup>That differences in initial economic conditions can have long lasting consequences on earnings in a reduced form sense was shown before by Oreopoulos, von Wachter and Heisz (2012) for the case of high school graduates in Canada.



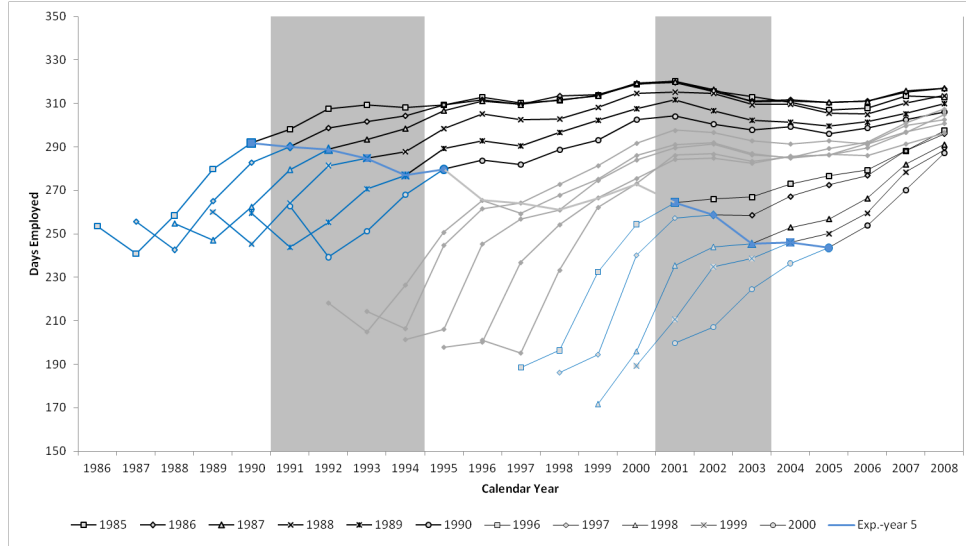


FIGURE 3.— Employment-Experience Profile by Graduation Year.

Notes: Average number of days full-time employed subject to social security contributions by cohort and year on the labor market. Areas shaded in grey indicate recessionary years. The horizontal line links observations of the fifth year on the labor market.

generated by averaging daily unemployment rates within employment years:

$$(5.1) \quad U_y = \frac{1}{365} \sum_{d=365(y-1)+1}^{365y} U_d.$$

$y$  indicates the year on the labor market and  $d$  gives the number of days that have passed since graduation. For purpose of presentation, the occurrence of leap years is ignored. Because individuals continuously enter the labor market, there is still variation in aggregate unemployment rates *within* a cohort of labor market entrants defined by calendar year of graduation. This allows conditioning on cohort fixed-effects which is the major advantage of our approach over using cohort-year variation in aggregate unemployment rates as source of identification [cf. Neumark (2002)]. Finally, the IV strategy identifies a local average treatment effect (LATE) under the following assumptions:

*A1 Relevance: The aggregate labor market conditions prevailing during early career are correlated with youth employment.* This is reasonable because establishing a stable employer-employee match should be easier when economic conditions are favorable.

*A2 Monotonicity: There are no defiers, i.e. individuals who are employed longer if labor market conditions are bad and employed shorter if labor market*

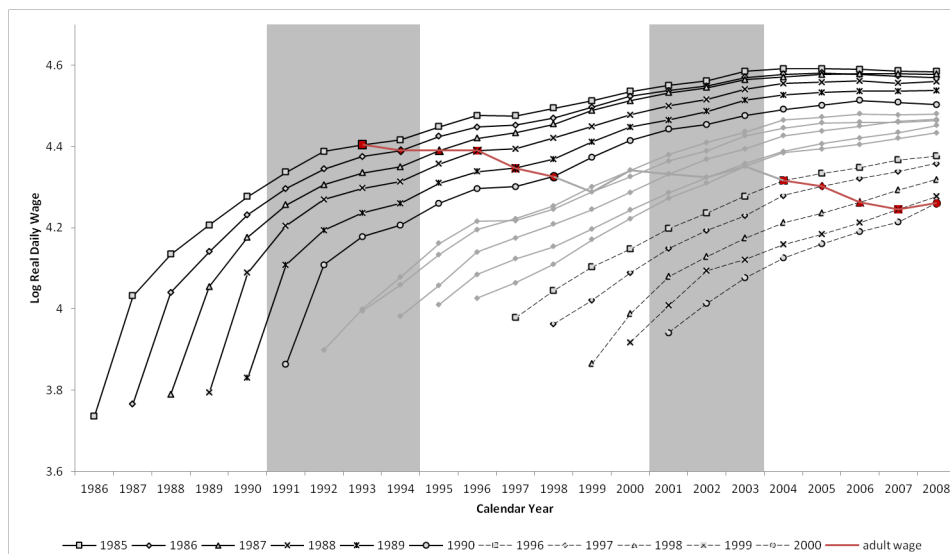


FIGURE 4.— Wage-Experience Profile by Graduation Year.

Notes: Average of log real daily wages by cohort and year on the labor market. Areas shaded in grey indicate recessionary years. The horizontal line links observations of the fifth year on the labor market.

conditions are good. This assumption intuitively makes sense in our application and is therefore not justified further.

*A3 Conditional Independence: Aggregate labor market conditions early in the professional career are independent of adult wages and early work experience, conditional on control variables.* Besides conditioning on an already rich set of control variables constructed from the time of labor market entry, controlling for cohort fixed-effects allows to hold time-invariant differences between cohorts constant. Furthermore, no cohort enters into a recession directly which to a large extent rules out anticipation effects.

*A4 Exclusion: After conditioning on early employment duration, adult wages are independent of aggregate labor market conditions prevailing during early-career.* Or put differently: There is an impact of aggregate unemployment on adult wages only via lacking labor market experience during the early years on the labor market. On the one hand, wages are measured at least eight years after graduation. Therefore, the existence of an early matching process frequently described in the literature and also confirmed in this paper suggests that individuals still have time to catch-up in any other matters than forgone work experience. On the other hand, all individuals suffer through a recession at some point in their career and already have left it when wages are measured. Therefore they live through the same economic and institutional changes entailed by

a recession. To control for any remaining persistence in aggregate labor market conditions, unemployment rates prevailing at the time of wage measurement are also controlled for [cf. Gregg (2001)].

If all the assumptions stated above hold, instrumental variable (IV) estimates of the returns to early employment stability permit a causal interpretation.

## 6. RESULTS

This section summarizes results from regressing adult wage on early employment stability. The logarithm of the real daily wage measured in the eighth employment year is the dependent variable. The key regressor is early employment stability, a cumulative measure of all days full-time employed between the second and the fifth year since graduation. Additional control variables are 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 trained and dummy variables for the cohort. They are described in more detail in Section 8.1. The only control variable measured after graduation is the aggregate unemployment rate in the eighth employment year. In a first step, we run regressions on the mean to investigate whether there is a causal link between early employment stability and adult wages at all. This is done separately for cohorts graduating in the late 1980s and late 1990s. Comparing the estimated returns provides insights into whether these have changed over time. In a second step, quantile regressions are utilized to investigate heterogenous impacts of early employment stability on the distribution of adult wages. In a third step, the wage distribution between graduates from the late 1980s and the late 1990s are decomposed into wage-structure and composition effects which provides some additional insights into the effect of changing employment patterns for youth on the wage inequality in adulthood.[Composition results are not yet included in this early version!]

### 6.1. Mean Regression Estimates – Just-Identification

Table I summarizes results from mean regressions of adult wage on early employment stability. Those are performed separately for cohorts entering the labor market during the period 1987-1990 and cohorts graduating between 1998-2000. The first three columns of Table I show the results for the cohorts graduating in the first time interval while the last three columns repeat the analysis for cohorts graduating in the second interval. Columns (1) and (4) display outputs from regressing adult wage on youth employment and a constant. Both regressions show a significant effect of one additional day employed as youth leading on average to .017% (1987-1990) and .03% (1998-2000) higher wages in prime age. Specifications of columns (2) and (5) add the full set of control variables.<sup>18</sup>

<sup>18</sup>Coefficients for most of them are displayed as well because the effects of initial conditions prevailing at labor market entry are quite interesting in themselves. All significant effects

TABLE I

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

	1987-1990			1998-2000		
	(1) OLS	(2) OLS	(3) IV	(4) OLS	(5) OLS	(6) IV
youth employment	.00018*** (7.1e-06)	.00016*** (7.2e-06)	.00034** (.00016)	.0003*** (9.9e-06)	.00025*** (9.8e-06)	.00067*** (.00017)
age		.11*** (.026)	.12*** (.026)		.13*** (.03)	.00054 (.062)
age squared		-.0022*** (.00063)	-.0023*** (.00064)		-.0025*** (.00069)	.00031 (.0013)
firm size		3.3e-06*** (5.4e-07)	3.1e-06*** (5.7e-07)		8.1e-06*** (1.0e-06)	5.9e-06*** (1.5e-06)
firm wage		.0041*** (.00023)	.0043*** (.00025)		.0045*** (.00025)	.0041*** (.00034)
cohort 1988		.015 (.0097)	.012 (.011)			
cohort 1989		-.012 (.016)	-.014 (.016)			
cohort 1990		-.08*** (.01)	-.079*** (.011)			
cohort 1999					-.023** (.01)	-.022* (.012)
cohort 2000					-.013 (.02)	-.00096 (.023)
adult UR ( $U_8$ )		-.046*** (.013)	-.042*** (.014)		.0088 (.011)	.0033 (.013)
district UR		-.0038*** (.00078)	-.0029** (.0011)		-.013*** (.0016)	-.0067** (.0033)
false report		.045*** (.0054)	.016 (.027)		.043*** (.012)	.036*** (.013)
constant	4.2*** (.0085)	3.2*** (.31)	2.9*** (.38)	4*** (.012)	2*** (.35)	3.2*** (.6)
Sector Dummies		✓	✓		✓	✓
Occupation Dummies		✓	✓		✓	✓
<i>GMM C-statistic</i>			1.28			7.78***
<i>First stage:</i>						
$U_{2/5}$			-84.42*** (18.8)			-166.61*** (32.72)
<i>robust F-statistic</i>			20.14***			25.93***
$R^2$	.052	.138	.086	.128	.242	.011
Observations	17,960	17,177	17,177	9,003	8,543	8,543

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 both cases the instrument is the aggregate unemployment rate averaged over the second to fifth year on the labor market ( $U_{2/5}$ ). Apart from the instrument, variables included in the regressions of youth employment are the same as in the estimates of adult wages. For variable definitions see Section 8.1.

Effects of early employment stability slightly decline compared to the raw effects presented in columns (1) and (4) but qualitatively there is no difference. The effects of one additional day employed as youth are now .016% (1987-1990) and .025% (1998-2000), respectively. This implies that staying one out of four possible years without full-time employment lowers average adult wages by approximately 6% (1987-1990) and 9% (1998-2000), *ceteris paribus*. These numbers seem quite small compared to what *ex-ante* might be expected. So concerns about a downward bias of OLS estimates of the returns to job stability might be justified.

The specifications displayed in columns (3) and (6) of Table I report results using the aggregate unemployment rate, in this first approach averaged over the second to fifth year on the labor market, as an instrument for youth employment stability. This is,

$$(6.1) \quad U_{2/5} = \frac{1}{4} \sum_{y=2}^5 U_y$$

is used as instrument. IV regressions are performed with the help of 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. The IV estimates of the returns to early employment stability are .034% for cohorts graduating 1987-1990 and .066% for cohorts graduating ten years later. In both cases they are statistically significant, at least on the 5% level. These effects are also substantially larger than the effects derived without instrumenting before, which is consistent with unobserved heterogeneity biasing the returns to work experience downward instead of upward. IV estimates indicate that staying one out of four possible years without full-time employment decreases adult wages on average by about 12% (1987-1990) and 24% (1998-2000), *ceteris paribus*.

To explore the validity of the IV results, Table I also contains the results from three additional tests: First, a test on whether youth employment has actually to be treated as endogenous. Second, a significance test on the instrument's coefficient in the first stage and finally, a F-test on the IV regression's first stage. The first test for the period 1987-1990 does not reject the null hypothesis of exogeneity with a GMM C statistic  $\chi^2(1)$  of 1.2 and a p-value of .25. This (cautiously) suggests that the specification of column (2) already permits a causal

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exhibit the expected signs. Characteristics of the training firm such as wage level and size have a significant positive impact on wages up to eight years later. Economic conditions in adulthood play a significant role for adult wages only in the late 1980s but local labor market conditions at graduation have a significant negative impact in the late 1990s as well. The dummy variable indicating December the 31<sup>st</sup> as day of graduation is significant and positive, maybe reflecting a positive selection of stayers. Finally, cohort effects are not significant for most of the time.

interpretation and that instrumenting is not necessary in the first place because OLS would provide a more efficient estimate in case of exogenous regressors. Yet, for the period 1998-2000 the null is rejected on any significance level, indicating that controlling for unobserved heterogeneity is indispensable in this model. The result that exogeneity of youth employment is not rejected in the first IV model but in the second one might also explain the more pronounced increase in coefficients on youth employment between the OLS and the IV specifications for the latter period: If unobserved factors are more important for younger cohorts, maybe because the returns to further education or job search have increased, downward bias is more pronounced and the correction of bias via instrumenting reveals a larger increase between OLS and IV coefficients.

With regard to the second test, the instrument's first stage coefficient in both IV models is negative, highly significant and reasonable in magnitude. This confirms *assumption A1: relevance of the instrument* stated in Section 5. The difference between the first stage effects in both models shows that employment duration is reduced considerably more by adverse labor market shocks for younger than for older cohorts. Finally, the first stage F-test for both specifications of columns (3) and (6) leads to a rejection of the null that the excluded instrument is irrelevant. The robust F-statistic in both IV models is significant and higher than ten, indicating no problem due to weak instrumentation.<sup>19</sup>

### 6.2. Mean Regression Estimates – Over-Identification

This section presents results of instrumental variable regressions on the mean of adult wages where aggregate unemployment rates on an annual level are used as instruments for early employment stability. Estimates from IV regressions with similar specifications to those of columns (3) and (6) of Table I are displayed in Table II. Instead of using the aggregate unemployment rate averaged over the second to fifth year, two unemployment rates averaged by experience years  $s$  and  $t$  are used jointly to instrument early employment stability. Focusing on the first interval 1987-1990 reveals significant effects of early employment stability only for the columns (2) to (4). One reason for this might be that the variation in youth employment induced by the recession of 1991-1994 is not strong enough in experience years 2 and 5, i.e. in the periods 1989-1992 or 1992-1995, respectively. All significant effects however are estimated to be positive and larger than the effects derived from the benchmark OLS regression in column (3) of Table I. Similar to what was found before, the test on exogeneity of youth employment does not reject this null throughout. Checking the validity of the instruments in the first stage reveals significant robust F-statistics for all models. Only the ones of columns (3) and (4) are close to ten, so those specifications might be trusted most. Since both effects are with .026% and .036% close to the marginal

<sup>19</sup>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).

TABLE II  
 INSTRUMENTAL VARIABLE REGRESSION ESTIMATES OF ADULT LOG REAL DAILY WAGE –  
 OVER-IDENTIFICATION

	(1)	(2)	(3)	(4)	(5)	(6)
$U_s$ & $U_t$ as instruments	$U_2$ & $U_3$	$U_2$ & $U_4$	$U_2$ & $U_5$	$U_3$ & $U_4$	$U_3$ & $U_5$	$U_4$ & $U_5$
1987-1990 (N = 17,177)						
youth employment	.00038 (.00029)	.00046** (.0002)	.00026* (.00015)	.00037** (.00017)	.00011 (.00018)	.00028 (.00021)
$R^2$	.059	.	.122	.069	.133	.113
GMM C-statistic	.59 [.43]	2.3 [.12]	.39 [.52]	1.5 [.2]	.091 [.76]	.34 [.55]
<i>First stage:</i>						
$U_s$	4.1 (13.77)	-16.1* (9.74)	-56.1*** (13.53)	-25.8*** (9.06)	-32.1*** (9.52)	-34.5*** (12.88)
$U_t$	-25.9** (12.7)	-35.7*** (10.42)	-56.6*** (13.03)	-38.3*** (10.51)	-30.9*** (9.95)	-2.1 (11.6)
robust F-statistic	3.4** [.033]	7.1*** [.0]	10.6*** [.0]	9.4*** [.0]	7.9*** [.0]	5.9*** [.002]
Hansen's J-statistic	3.9** [.048]	2.1 [.14]	3.8* [.05]	.108 [.74]	2.3 [.12]	5.4** [.019]
1998-2000 (N = 8,543)						
youth employment	.00061*** (.00012)	.00033** (.00014)	.00061*** (.00011)	.00058*** (.00011)	.00063*** (.00012)	.00053*** (.00011)
$R^2$	.069	.234	.074	.099	.048	.137
GMM C-statistic	11.7*** [.0006]	.273 [.6]	12.7*** [.0004]	10.1*** [.0015]	13.3*** [.0003]	7.2*** [.0071]
<i>First stage:</i>						
$U_s$	16.2 (28.56)	-128.3* (68.89)	181.7*** (28.39)	-323.4*** (58.57)	-340*** (56.89)	-155.8*** (25.51)
$U_t$	-352.5*** (57.7)	-237.5*** (67.07)	-69.5*** (10.66)	-43.3 (28.21)	-11.5 (10.58)	-54.1*** (9.85)
robust F-statistic	25.9*** [.0]	13.8*** [.0]	28.8*** [.0]	26.9*** [.0]	26.2*** [.0]	26.9*** [.0]
Hansen's J-statistic	.78 [.37]	1.07 [.29]	.7 [.4]	2.9* [.084]	.46 [.49]	1.8 [.17]
Control Variables	✓	✓	✓	✓	✓	✓
Cohort Dummies	✓	✓	✓	✓	✓	✓
Constant	✓	✓	✓	✓	✓	✓

Notes: robust standard errors in parentheses; p-values in brackets; \*  $p < .1$ , \*\*  $p < .05$ , \*\*\*  $p < .01$ ; IV regressions are performed with Hansen, Heaton and Yaron's (1996) continuously-updated GMM estimator implemented in the Stata command *ivregress*; The instruments are aggregate daily unemployment rates averaged by employment year  $t$  and  $s$ . Apart from the instruments, variables included in the regressions of youth employment are the same as in the estimates of adult wages. For variable definitions see Section 8.1.

effect of .034% derived in the just-identified case, where the first stage F was about 20, we are quite confident that there is no weak instrumental variable problem. The instruments' coefficients are also negative, significant and reasonable in size. Since there are now two instruments for one endogenous regressor a test for overidentifying restrictions can be applied. Hansen's J-statistic is not significant on the 5% level for the specifications of columns (2) and (3). The null hypothesis of both instruments being exogenous can clearly not be rejected for the specification of column (4). Turning to the results for the younger cohorts graduating 1998-2000 reveals significant marginal effects around .06%, as was the marginal effect derived under just-identification. Only the specification of column (2), where unemployment rates from experience years 2 and 4 are used as instruments, shows a weaker effect of .032%, which is still larger than the OLS estimate of .025%. The exogeneity of early employment stability in the wage regression for younger cohorts is still rejected throughout, the first stage's robust F is way above ten for all specifications and the significant effects of the instruments in the first stage confirm their relevance. With regard to exogeneity of the instruments, the Hansen test does not reject the hypothesis of correct exclusion of the instruments from the structural equation for all specifications on the 5% level.

So far we have shown that early employment stability has a significant impact on wages later in life. IV estimates show larger effects than OLS estimates which suggests that the overall bias in OLS estimates is negative. If this is true, effects derived from OLS regressions can be interpreted as lower bounds. However, the result of a significant positive return to early employment stability holds irrespective of the method used, suggesting that there is indeed a causal link. The same is true for the hypothesis of increasing returns to early employment stability between cohorts entering the labor market during the late 1980s and the late 1990s which cannot be rejected in both IV and OLS specifications. Because, until now, solely effects on the mean of adult wages were investigated, no statements about the contribution of employment instability to wage inequality are possible. This is why the next section will investigate heterogenous impacts of early employment stability over the whole distribution of adult wages.

### 6.3. *Quantile Regression Estimates*

To explore whether returns to early employment stability are heterogenous across the (conditional) adult wage distribution, quantile regression (QR) models, introduced by [Koenker and Bassett \(1978\)](#), are estimated for each percentile. The specification of these models is similar to the ones reported in column (2) and (5) of [Table I](#). For the older cohorts graduating in the period 1987-1990, [Figure 5](#) shows that most effects of youth employment are significantly different from zero. Furthermore, they continuously decrease the higher the quantile considered. The effect on the 90<sup>th</sup> percentile is quite precisely estimated to be



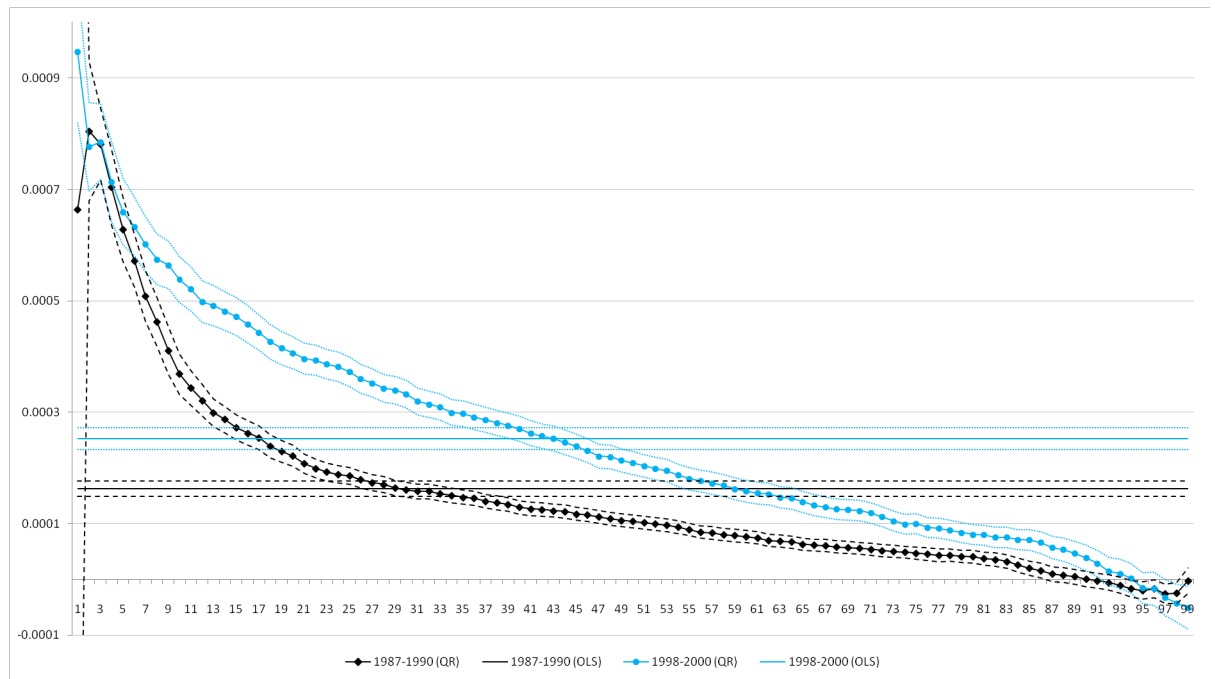


FIGURE 5.— Quantile Regression Estimates of the Returns to Early Employment Stability

Notes: Coefficients on youth employment from OLS and QR. 95% confidence intervals indicated by dashed lines. In case of OLS robust standard errors were used. In case of QR confidence intervals were bootstrapped with 200 replications. Model specifications are similar to those of column (2) and (5) of Table 1. For variable definitions see Section 8.1.

close to zero while the marginal effect on the 10<sup>th</sup> (20<sup>th</sup>) percentile is significant and with .037% (.022%) also clearly larger than the marginal effect on the mean, which was estimated by OLS to be .016%. A similar picture emerges for the period 1998-2000: the effects of youth employment on all deciles of the adult wage distribution are significant and again they decrease remarkably the higher the percentile considered. The marginal effects on the lower three deciles are also larger than the effect on the mean and the effect on the 90<sup>th</sup> percentile is, although statistically significant, not economically significant. The QR results therefore suggest that differences in work experience accumulated early in the professional career not only shift the location of the wage distribution in adulthood but also alter its shape, i.e. have an impact on the variability of wages earned later in life.

However, increasing and heterogenous returns to early employment stability do not necessarily imply raising wage inequality over time. For example, an already high level of wage inequality would not change if all quantiles shift parallel upward between periods under investigation, as is observed in a similar application by Buchinsky (1994). Further investigation of the quantile treatment effects from Figure 5 shows that this is not what is happening: while the effects on the 80<sup>th</sup> and 90<sup>th</sup> percentile indeed shift upward by roughly the same amount, the *difference* between the deciles of the corresponding distributions starts to reduce from .016 percentage points (10<sup>th</sup> percentile) to .006 percentage points (70<sup>th</sup> percentile), with a maximum of .019 percentage points at the 15<sup>th</sup> percentile.

This pattern suggests that asymmetric increases of the returns to employment stability contributed to a widening of the lower tail of the adult wage distribution. This is consistent with changing employment patterns contributing to higher wage inequality. The effect of employment stability on the upper tail of the wage distribution however proves to be quite small in general and does not seem to have substantially changed over time.

#### 6.4. *Quantile Instrumental Variable Regression Estimates – Just-Identification*

Quantile regression estimates presented so far have only a causal interpretation under the strong assumption that the duration of employment in youth is exogenous to the wage setting process in adulthood. Although a test whether youth employment in the IV model for the period 1987-1990 can be treated as exogenous did not reject this null, instrumentation of the quantile effects is necessary to validate the results found so far. A quantile instrumental variable (QIV) method that allows for instrumentation of a continuous endogenous regressor in a quantile regression framework is developed by Chernozhukov and Hansen (2005). Under the conditions stated therein, involving *assumption A1: relevance* and *assumption A2: conditional independence* stated above, a quantile treatment effect (QTE) is identified without having to rely on functional form assumptions. Furthermore, this “[.] approach identifies the marginal quantiles of potential outcomes, as is typically required in welfare analysis, but does not

identify the joint distribution of outcomes, unless the extreme case of rank similarity (rank invariance) is imposed” [Chernozhukov and Hansen (2005, p.255)]. Intuitively and in light of our application, rank invariance implies that a high-ability worker who is displaced early during a recession, is still a high earner relative to a worker of low ability who is not displaced. This assumption can be relaxed by imposing rank similarity which implicitly allows for endogenous treatment assignment as long as it is not based on the knowledge of the exact potential outcomes. These conditions have to be kept in mind while interpreting the results.

Results from applying QIV to quantile models with specifications identical to those of columns (3) and (6) of Table I, i.e. the exact identified case with the aggregate unemployment rate averaged over the second to fifth employment year as instrument, are displayed in the first row of Figure 6. The QIV results broadly confirm the QR results discussed above. Because effects on the lower tail are estimated quite imprecisely they should only be interpreted with caution. Yet again, quantile effects decrease the higher the percentile of adult wages considered. Different from the result found before, effects for the older cohorts seem to decrease only until the 25<sup>th</sup> and then remain quite flat. The coefficient on youth employment is generally larger for younger cohorts confirming an increase in the returns to early employment stability over time. This increase is again particularly pronounced around the 30<sup>th</sup> percentile and quantiles above the median seem to shift almost parallel upward. Finally, all the effects derived with the help of QIV are larger than those derived without instrumenting. This is again in favor of unobserved heterogeneity biasing returns to employment stability downward.

#### 6.5. *Quantile Instrumental Variable Regression Estimates – Over-Identification*

To complete the discussion on quantile treatment effects, the second and third row of Figure 6 contains results from QIV regressions similar to those performed in the chapter before but using the average unemployment rate in experience years {2} and {5} or {3} and {4}, respectively, jointly to instrument early employment stability. Inference is based on formulas in Chernozhukov and Hansen (2008) instead of bootstrapping. The estimated quantile treatment effects confirm an increase of the returns to employment stability between cohorts. This increase is more pronounced in the lower than in the upper tail. For the older cohorts, the overall picture confirms a general weakening of effects the higher the quantile under consideration. The equivalent picture for the younger cohorts graduating between 1998 and 2000 shows that effects decline more rapidly. In comparison with the simple quantile regression estimates, which are also contained in the figure, instrumenting seems to shift all the effects at each percentile upward by about the same amount. The increase of the estimated returns with instrumenting for the younger cohorts is also stronger than for the older cohorts in the upper half of the distribution. Taking all the evidence together, returns to early employment stability seem to have risen considerably more in a region

of the adult wage distribution between the 30<sup>th</sup> percentile and the median but less so at the lowest two deciles.

## 7. CONCLUSIONS

Card, Kline and Heining (2012) document a raising assortativeness between high paying employers and high earning employees as a major source of growing wage inequality over the past three decades in Germany. If the variation in the quality of jobs available to a given worker decisively depends on the previous employment history, changing patterns of state dependence between early employment stability and adult wages provides a further explanation for Germany's increasing wage inequality.

The approach pursued in this paper is to explain wages of prime-aged men by employment stability experienced early in professional life. Three labor market entry cohorts between three different entry periods [1977-1980; 1987-1990; 1998-2000] are compared. Three questions are of interest: First, at a given duration, have the returns to employment stability changed over time? Second, holding returns constant, does decreasing job stability in youth contribute to increasing wage inequality in adulthood? Third, to which extent is the increasing variation in wages attributable to this type of state dependence?

Descriptive evidence shows that early employment stability has declined primarily since the late 1980s and only at already relatively short durations. At the same time, job security does not seem to have substantially decreased. An instrumental variable strategy was developed which utilizes *within* cohort-year variation in aggregate labor market conditions induced by the recessions of 1991-1994 and 2001-2003, respectively, as exogenous variation in employment stability. The IV results show that the returns to early employment stability in terms of adult wages have considerably increased between the late 1980s and late 1990s: while one additional day of youth employment raises adult wages on average by 0.034% for cohorts entering in the late 1980s, this effect has increased to 0.066% for cohorts entering in the late 1990s. Furthermore, IV results suggest OLS estimates of these returns to be biased downwards. This is consistent with the view of Neumark (2002) that unobserved returns to search mask the true scarring effect. Furthermore, results from an instrumental variable quantile regression model proposed by Chernozhukov and Hansen (2005) reveal heterogeneous impacts of youth employment across the distribution of adult wages: while marginal effects are especially pronounced in the lower half of this distribution, returns to employment stability are substantially smaller at the top. With regard to wage inequality, quantile treatment effects diverge asymmetrically between the two periods of comparison with an increase especially pronounced in a region of the adult wage distribution between the 30<sup>th</sup> percentile and the median. This suggests a contribution of this kind of state dependence to growing wage inequality mainly from the bottom of the wage distribution. However, this has to be further validated in future research and decomposition methods will be applied to assess

the importance of wage structure and composition effects.

#### ACKNOWLEDGEMENTS

We thank Joachim Möller, Bernd Fitzenberger, Stefan Bender, Philipp vom Berge and Achim Schmillen. The usual disclaimer applies.

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1679-1705.



## 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 training in one occupation with less than 32 days in between. About 20% of all individuals exhibit more than one period of training according to this definition. More than three periods occur in less than one percent of all cases. Graduation is usually defined as the end of the first training period. The only exception is the first period lasting less than a year and being followed by a further apprenticeship period within 92 days. In this case, and if the individual is younger than 27 years when further training is started, the end of the second period is defined as graduation. Only individuals older than 15 and younger than 30 at graduation enter the sample. In some minority of cases duration of training is unrealistically long because employers seem to have missed to update the status of trainees staying at the training firm. In a first attempt this is corrected by identifying the true graduation spell using an increase of training wages between spells that is implausibly large. A threshold of 60% wage increase is chosen which should never be observed between years of training within an apprenticeship. Since wages in such a corresponding spell are reported as weighted average of the wage received as a trainee and as a regular employee with duration of time spent in each of the two categories as weights, the true day of graduation can be estimated using the wages a spell before and a spell after as reference. In a second step, the complete histories of individuals whose initial training period lasts longer than four years or less than one month are dropped.

Among the remaining apprentices all women are excluded because of their potentially weak labor market attachment. Furthermore, only men registered as German citizens at some point in time are selected. To make graduates as equal as possible with regard to former labor market experience, those who exhibit a high-school diploma at the day of graduation are excluded as well. Finally, only careers starting in West Germany are considered where Berlin is assigned to East Germany.

To avoid the problem of "bad controls", 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 wage trends. The age at graduation might either reflect a longer time spent in education or lacking perseverance. Therefore, the net effect of graduation age on adult wages is a priori ambiguous.

*Size of the training firm.* Size is measured by the number of employees (in 1000) employed subject to social security contributions on June 30<sup>th</sup> of the graduation year. Since it is well known that wage premia positively depend on firm size, a positive relation between this variable and adult wages might be expected.

*Wage level of the training firm.* Wage level is captured by the median wage of all employees subject to social security contributions on June 30<sup>th</sup> of the

graduation year. A high wage level might be a signal for high bargaining power and/or productive training conditions. Therefore, a positive relation between this variable and adult wages might be observed.

*Sector of the training firm.* The sector 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. An additional dummy variable for missing values is included.

*Labor market entry cohort.* Cohort dummies are included to control for effects specific to a cohort of labor market entrants, like differences in size or composition. Furthermore, they control for longer-term trends, e.g. related to the economic cycle or the quality of the German education system.

*Occupation.* The occupation trained is modeled with 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, semiprofessions and professions, unskilled commercial occupations, skilled commercial occupations and managers. The reference category is unskilled manual occupations. Because the variable capturing occupation exhibits a lot of missing values a dummy variable for missing values is added as an additional control.

*Local unemployment 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. This is why initial labor market conditions are controlled for by county-specific unemployment rates, where the county is defined by the training firm's local labor market according to the definition of Germany's Federal Employment Agency.

*Adult unemployment.* To capture persistent patterns in labor market conditions on the national level, the average aggregate unemployment rate prevailing during the eighth year since graduation is used as an additional control variable.

*False report.* Due to peculiarities of the notification procedure a considerable proportion of employers did not accurately report the day of graduation before 1991. As a consequence, for almost half of the graduates from a cohort December 31<sup>st</sup> is reported as the day of graduation. This comprises a problem for the validity of the identification strategy outlined in [Section 5](#) if these false reports happen systematically, maybe because employers report December 31<sup>st</sup> as the day of graduation primarily for individuals who are staying at the training firm. If stayers are positively selected IV estimates would be biased in an unknown direction, depending on the unemployment level prevailing in the following calendar year. To avoid sample selection bias by dropping affected observations a dummy variable indicating such a "false report" is included. Empirically it turns out that both the first stage as well as the reduced form estimates of regres-

sions similar to the ones reported in Section 6.1 besides omitting this dummy variable show an unexpected positive sign. However, bias seems to impact both estimates in a similar way and IV estimates, which are calculated as the quotient of reduced form and first stage estimates, omitting the dummy variable are not qualitatively different from IV estimates with the dummy variable included. Yet, in the latter case both the reduced form and the first stage estimates show the expected negative signs which fosters confidence in the dummy variable doing a good job in controlling for any potential bias induced through this channel. Albeit this problem is not of relevance for cohorts graduating after 1990 this dummy variable will be included in the regressions for the period 1998-2000 as well.

### 8.2. Supplementary Tables and Figures

Table V: Quantile regression estimates of adult wage

percentile	QR		QIV ( $U_{2/5}$ )		QIV ( $U_3$ & $U_4$ )		QIV ( $U_2$ & $U_5$ )	
	coeff	se	coeff	se	coeff	se	coeff	se
1987-1990 (N = 17,177)								
1	0.00066	7.68E-04	-0.00195	0.03632	-0.00027	0.00000	-0.00189	0.00180
2	0.00080	6.36E-05	0.00001	0.02937	-0.00006	0.00740	0.00041	0.00234
3	0.00078	3.27E-05	0.00061	0.00052	0.00185	0.00043	0.00066	0.00018
4	0.00070	3.48E-05	0.00061	0.00109	0.00081	0.00058	0.00141	0.00050
5	0.00063	2.95E-05	0.00083	0.00109	0.00170	0.00049	0.00106	0.00024
6	0.00057	2.43E-05	0.00057	0.00100	0.00163	0.00062	0.00129	0.00070
7	0.00051	2.32E-05	0.00057	0.00956	0.00056	0.00027	0.00070	0.00067
8	0.00046	2.24E-05	0.00094	0.00109	0.00105	0.00019	0.00071	0.00090
9	0.00041	2.16E-05	0.00096	0.00073	0.00121	0.00039	0.00097	0.00035
10	0.00037	1.85E-05	0.00099	0.00099	0.00104	0.00033	0.00092	0.00014
11	0.00034	1.61E-05	0.00084	0.00098	0.00093	0.00051	0.00052	0.00069
12	0.00032	1.42E-05	0.00086	0.00070	0.00104	0.00035	0.00085	0.00048
13	0.00030	1.28E-05	0.00086	0.00058	0.00109	0.00024	0.00079	0.00025
14	0.00029	1.21E-05	0.00089	0.00060	0.00103	0.00037	0.00071	0.00023
15	0.00027	1.15E-05	0.00091	0.00061	0.00092	0.00026	0.00067	0.00027
16	0.00026	1.11E-05	0.00085	0.00042	0.00086	0.00020	0.00079	0.00043
17	0.00025	1.08E-05	0.00088	0.00063	0.00089	0.00030	0.00053	0.00020
18	0.00024	1.04E-05	0.00088	0.00063	0.00090	0.00200	0.00079	0.00263
19	0.00023	1.00E-05	0.00092	0.00051	0.00093	0.00160	0.00027	0.00027
20	0.00022	9.61E-06	0.00086	0.00052	0.00092	0.00088	0.00033	0.00011
21	0.00021	8.96E-06	0.00033	0.00069	0.00032	0.00014	0.00030	0.00011
22	0.00020	8.54E-06	0.00029	0.00110	0.00090	0.00037	0.00028	0.00011

23	0.00019	8.22E-06	0.00038	0.00342	0.00038	0.00042	0.00036	0.00029
24	0.00019	7.98E-06	0.00034	0.00110	0.00034	0.00017	0.00036	0.00019
25	0.00019	7.84E-06	0.00075	0.00068	0.00088	0.00017	0.00030	0.00010
26	0.00018	7.61E-06	0.00043	0.01315	0.00086	0.00035	0.00049	0.00012
27	0.00017	7.39E-06	0.00045	0.00206	0.00045	0.00012	0.00061	0.00035
28	0.00017	7.20E-06	0.00063	0.00058	0.00072	0.00023	0.00054	0.00043
29	0.00016	7.00E-06	0.00045	0.00049	0.00073	0.00020	0.00056	0.00015
30	0.00016	6.85E-06	0.00046	0.00045	0.00064	0.00019	0.00036	0.00018
31	0.00016	6.74E-06	0.00039	0.00020	0.00048	0.00034	0.00031	0.00012
32	0.00016	6.70E-06	0.00046	0.00036	0.00036	0.00011	0.00029	0.00008
33	0.00015	6.62E-06	0.00038	0.00020	0.00043	0.00034	0.00029	0.00012
34	0.00015	6.54E-06	0.00040	0.00020	0.00042	0.00011	0.00029	0.00016
35	0.00015	6.47E-06	0.00041	0.00018	0.00041	0.00020	0.00031	0.00012
36	0.00015	6.43E-06	0.00039	0.00018	0.00040	6.74E-05	0.00032	0.00027
37	0.00014	6.34E-06	0.00041	0.00017	0.00041	7.37E-05	0.00036	0.00019
38	0.00014	6.29E-06	0.00042	0.00016	0.00042	9.16E-05	0.00039	0.00011
39	0.00013	6.23E-06	0.00043	0.00017	0.00047	1.63E-04	0.00038	0.00019
40	0.00013	6.15E-06	0.00047	0.00018	0.00049	1.35E-04	0.00038	0.00028
41	0.00013	6.11E-06	0.00050	0.00019	0.00050	8.68E-05	0.00031	0.00014
42	0.00013	6.07E-06	0.00041	0.00016	0.00039	2.69E-04	0.00032	9.10E-05
43	0.00012	6.02E-06	0.00040	0.00016	0.00047	1.41E-04	0.00032	8.57E-05
44	0.00012	5.99E-06	0.00046	0.00015	0.00046	1.43E-04	0.00030	9.69E-05
45	0.00012	5.94E-06	0.00042	0.00015	0.00044	6.05E-05	0.00032	7.12E-05
46	0.00012	5.91E-06	0.00044	0.00014	0.00045	7.19E-05	0.00037	2.52E-04
47	0.00011	5.88E-06	0.00045	0.00014	0.00046	6.17E-05	0.00033	1.18E-04
48	0.00011	5.86E-06	0.00046	0.00014	0.00046	1.26E-04	0.00034	3.74E-04
49	0.00011	5.86E-06	0.00044	0.00014	0.00044	6.08E-05	0.00036	2.78E-04
50	0.00010	5.84E-06	0.00044	0.00014	0.00044	5.77E-05	0.00040	1.98E-04
51	0.00010	5.83E-06	0.00043	0.00014	0.00045	8.92E-05	0.00041	6.65E-05
52	9.99E-05	5.82E-06	0.00042	0.00015	0.00042	9.78E-05	0.00040	1.98E-04
53	9.76E-05	5.80E-06	0.00043	0.00014	0.00043	9.80E-05	0.00037	1.36E-04
54	9.37E-05	5.79E-06	0.00044	0.00014	0.00044	7.24E-05	0.00034	5.41E-05
55	8.95E-05	5.76E-06	0.00045	0.00014	0.00044	1.83E-04	0.00033	7.92E-05
56	8.48E-05	5.74E-06	0.00038	0.00015	0.00037	2.02E-03	0.00034	9.91E-05
57	8.34E-05	5.72E-06	0.00048	0.00013	0.00048	9.92E-05	0.00044	1.03E-04
58	8.04E-05	5.69E-06	0.00049	0.00013	0.00050	6.79E-05	0.00038	8.32E-05
59	7.88E-05	5.66E-06	0.00048	0.00014	0.00043	1.10E-04	0.00030	6.82E-05
60	7.69E-05	5.63E-06	0.00043	0.00015	0.00038	1.50E-04	0.00028	3.25E-04
61	7.47E-05	5.61E-06	0.00044	0.00015	0.00044	1.00E-04	0.00029	9.50E-04
62	6.98E-05	5.57E-06	0.00037	0.00014	0.00035	7.66E-05	0.00028	5.50E-05
63	6.88E-05	5.56E-06	0.00036	0.00013	0.00035	1.00E-04	0.00029	5.84E-05
64	6.71E-05	5.55E-06	0.00037	0.00013	0.00038	1.20E-04	0.00028	5.35E-05
65	6.34E-05	5.53E-06	0.00030	0.00011	0.00030	7.43E-05	0.00028	5.21E-05
66	6.15E-05	5.54E-06	0.00032	0.00011	0.00031	3.28E-04	0.00028	4.67E-05

67	6.07E-05	5.53E-06	0.00035	0.00011	0.00035	9.64E-05	0.00028	4.08E-05
68	5.85E-05	5.52E-06	0.00035	0.00011	0.00036	7.02E-05	0.00029	9.76E-05
69	5.74E-05	5.51E-06	0.00032	0.00011	0.00033	2.60E-04	0.00030	5.15E-05
70	5.57E-05	5.50E-06	0.00033	0.00011	0.00036	6.82E-05	0.00026	1.64E-04
71	5.43E-05	5.52E-06	0.00036	0.00011	0.00036	8.00E-05	0.00023	6.90E-05
72	5.19E-05	5.52E-06	0.00033	0.00011	0.00034	7.87E-05	0.00021	1.07E-04
73	5.01E-05	5.54E-06	0.00035	0.00011	0.00035	8.20E-05	0.00024	3.28E-04
74	4.88E-05	5.55E-06	0.00034	0.00011	0.00035	5.24E-05	0.00032	5.72E-05
75	4.73E-05	5.57E-06	0.00035	0.00011	0.00036	6.40E-05	0.00030	9.40E-05
76	4.54E-05	5.60E-06	0.00013	0.00017	0.00037	6.22E-05	0.00021	5.87E-05
77	4.31E-05	5.65E-06	0.00034	0.00013	0.00016	4.68E-05	0.00013	6.56E-05
78	4.34E-05	5.69E-06	0.00018	0.00020	0.00017	5.47E-04	0.00023	3.52E-05
79	4.15E-05	5.77E-06	0.00016	0.00018	0.00015	9.46E-05	0.00014	5.32E-05
80	4.12E-05	5.86E-06	0.00016	0.00017	0.00017	9.50E-05	0.00013	8.18E-05
81	3.74E-05	5.97E-06	0.00025	0.00019	0.00027	7.64E-05	0.00010	5.56E-05
82	3.58E-05	6.10E-06	0.00020	0.00016	0.00022	7.67E-05	0.00013	9.26E-05
83	3.22E-05	6.28E-06	0.00018	0.00015	0.00011	7.59E-05	0.00014	9.89E-05
84	2.58E-05	6.46E-06	8.94E-05	0.00010	0.00014	5.91E-05	5.53E-05	7.27E-05
85	2.00E-05	6.60E-06	9.85E-05	0.00010	8.11E-05	1.18E-04	5.44E-05	4.44E-05
86	1.60E-05	6.67E-06	1.15E-04	9.84E-05	1.22E-04	1.02E-04	5.43E-05	9.55E-04
87	9.59E-06	6.74E-06	1.34E-04	8.45E-05	1.26E-04	4.66E-05	8.26E-05	6.16E-05
88	7.86E-06	6.78E-06	1.05E-04	7.94E-05	1.08E-04	5.29E-05	8.79E-05	3.85E-05
89	4.93E-06	6.81E-06	9.25E-05	8.32E-05	8.32E-05	1.28E-04	7.58E-05	7.05E-05
90	4.22E-07	6.86E-06	6.21E-05	7.08E-05	6.24E-05	5.00E-05	5.26E-05	6.58E-05
91	-2.26E-06	6.93E-06	3.09E-05	6.50E-05	3.14E-05	2.98E-05	2.58E-05	1.30E-04
92	-5.55E-06	7.11E-06	2.44E-05	7.80E-05	1.02E-05	5.23E-05	8.80E-06	4.88E-05
93	-1.05E-05	7.40E-06	5.39E-06	6.38E-05	7.41E-06	1.41E-04	8.07E-06	2.63E-05
94	-1.64E-05	7.66E-06	-3.18E-06	5.26E-05	-4.66E-07	3.70E-05	-3.36E-05	4.47E-05
95	-2.00E-05	7.95E-06	-8.72E-05	1.79E-04	-1.52E-04	6.65E-05	-1.89E-04	1.46E-04
96	-1.68E-05	8.26E-06	-1.66E-04	1.14E-04	-1.81E-04	9.64E-05	-1.91E-04	9.22E-05
97	-2.56E-05	8.83E-06	-1.54E-04	1.05E-04	-1.55E-04	2.30E-04	1.42E-04	5.33E-05
98	-2.45E-05	9.80E-06	2.18E-04	3.50E-04	-2.31E-06	7.15E-05	-9.27E-05	7.96E-05
99	-2.29E-06	1.17E-05	2.25E-05	2.13E-04	5.42E-05	1.11E-04	-8.84E-06	4.72E-04

1998-2000 (N = 8,543)

1	0.00095	6.48E-05	-0.00070	0.00127	0.00184	0.00045	0.00053	0.00158
2	0.00078	4.06E-05	-0.00013	0.00050	0.00200	0.00081	0.00273	0.00315
3	0.00079	3.47E-05	0.00032	0.00050	0.00142	0.00232	0.00083	0.00022
4	0.00071	3.67E-05	0.00060	0.00057	0.00095	0.00031	0.00080	0.00017
5	0.00066	3.07E-05	0.00077	0.00068	0.00082	0.00012	0.00076	0.00274
6	0.00063	2.69E-05	0.00096	0.00025	0.00086	0.00009	0.00203	0.00668
7	0.00060	2.52E-05	0.00132	0.01017	0.00079	0.00028	0.00183	0.00107
8	0.00057	2.31E-05	0.00125	0.00223	0.00076	0.00013	0.00078	0.00016
9	0.00056	2.17E-05	0.00178	0.01462	0.00083	0.00016	0.00113	0.00036

10	0.00054	2.11E-05	0.00143	0.00387	0.00091	0.00023	0.00105	0.00018
11	0.00052	2.03E-05	0.00139	0.00684	0.00089	0.00015	0.00103	0.00012
12	0.00050	1.91E-05	0.00122	0.00066	0.00094	0.00047	0.00104	0.00014
13	0.00049	1.84E-05	0.00159	0.00337	0.00092	0.00016	0.00102	0.00032
14	0.00048	1.78E-05	0.00186	0.00560	0.00088	0.00014	0.00096	0.00029
15	0.00047	1.75E-05	0.00174	0.02157	0.00093	0.00016	0.00109	0.00011
16	0.00046	1.69E-05	0.00199	0.00410	0.00096	0.00014	0.00104	0.00045
17	0.00044	1.63E-05	0.00123	0.00049	0.00096	0.00015	0.00099	0.00016
18	0.00043	1.58E-05	0.00139	0.00113	0.00091	0.00014	0.00100	0.00014
19	0.00041	1.52E-05	0.00090	0.00053	0.00092	0.00022	0.00093	0.00023
20	0.00041	1.47E-05	0.00139	0.00094	0.00091	0.00018	0.00110	0.00033
21	0.00040	1.41E-05	0.00133	0.00077	0.00090	0.00015	0.00094	0.00020
22	0.00039	1.38E-05	0.00126	0.00059	0.00094	0.00019	0.00097	0.00019
23	0.00039	1.36E-05	0.00122	0.00050	0.00091	0.00011	0.00094	0.00014
24	0.00038	1.34E-05	0.00117	0.00050	0.00089	0.00014	0.00094	0.00015
25	0.00037	1.33E-05	0.00110	0.00062	0.00082	0.00013	0.00092	0.00017
26	0.00036	1.31E-05	0.00141	0.00082	0.00082	0.00010	0.00084	0.00014
27	0.00035	1.29E-05	0.00104	0.00062	0.00080	0.00012	0.00080	0.00009
28	0.00034	1.27E-05	0.00091	0.00043	0.00078	0.00010	0.00079	0.00012
29	0.00034	1.27E-05	0.00087	0.00034	0.00078	0.00009	0.00080	0.00011
30	0.00033	1.26E-05	0.00090	0.00039	0.00076	0.00009	0.00077	0.00009
31	0.00032	1.23E-05	0.00086	0.00029	0.00075	0.00017	0.00080	0.00011
32	0.00031	1.22E-05	0.00086	0.00028	0.00081	0.00022	0.00084	0.00012
33	0.00031	1.20E-05	0.00088	0.00029	0.00081	0.00017	0.00082	0.00012
34	0.00030	1.18E-05	0.00091	0.00028	0.00080	0.00016	0.00080	0.00013
35	0.00030	1.17E-05	0.00096	0.00032	0.00084	0.00016	0.00084	0.00011
36	0.00029	1.16E-05	0.00105	0.00038	0.00072	0.00023	0.00082	0.00012
37	0.00029	1.16E-05	0.00097	0.00031	0.00082	0.00011	0.00082	0.00013
38	0.00028	1.15E-05	0.00099	0.00031	0.00078	0.00018	0.00081	0.00016
39	0.00028	1.15E-05	0.00097	0.00032	0.00074	0.00040	0.00081	0.00011
40	0.00027	1.14E-05	0.00095	0.00027	0.00075	0.00017	0.00081	0.00011
41	0.00026	1.14E-05	0.00091	0.00025	0.00076	0.00021	0.00079	0.00022
42	0.00026	1.13E-05	0.00094	0.00024	0.00076	0.00023	0.00077	0.00028
43	0.00025	1.13E-05	0.00089	0.00022	0.00074	0.00015	0.00081	0.00026
44	0.00025	1.12E-05	0.00089	0.00022	0.00069	0.00027	0.00077	0.00025
45	0.00024	1.12E-05	0.00083	0.00023	0.00065	0.00026	0.00073	0.00012
46	0.00023	1.11E-05	0.00079	0.00023	0.00062	0.00032	0.00070	0.00016
47	0.00022	1.09E-05	0.00073	0.00019	0.00067	0.00007	0.00072	0.00009
48	0.00022	1.09E-05	0.00072	0.00018	0.00067	0.00020	0.00070	0.00008
49	0.00021	1.07E-05	0.00068	0.00017	0.00063	0.00014	0.00068	0.00011
50	0.00021	1.06E-05	0.00069	0.00017	0.00064	0.00013	0.00069	0.00012
51	0.00020	1.05E-05	0.00072	0.00017	0.00062	0.00014	0.00066	0.00012
52	0.00020	1.05E-05	0.00068	0.00017	0.00062	0.00014	0.00066	0.00012
53	0.00020	1.04E-05	0.00066	0.00018	0.00061	0.00013	0.00066	0.00010

54	0.00019	1.03E-05	0.00064	0.00018	0.00062	0.00015	0.00065	0.00014
55	0.00018	1.02E-05	0.00063	0.00019	0.00058	0.00020	0.00063	0.00011
56	0.00018	1.02E-05	0.00061	0.00019	0.00057	0.00018	0.00067	0.00047
57	0.00017	1.01E-05	0.00068	0.00019	0.00054	0.00015	0.00066	0.00047
58	0.00017	1.01E-05	0.00081	0.00019	0.00062	0.00015	0.00065	0.00054
59	0.00016	1.01E-05	0.00076	0.00020	0.00058	0.00013	0.00064	0.00044
60	0.00016	1.01E-05	0.00064	0.00020	0.00058	0.00010	0.00062	0.00012
61	0.00015	1.00E-05	0.00070	0.00021	0.00059	0.00009	0.00067	0.00013
62	0.00015	9.94E-06	0.00069	0.00021	0.00059	0.00008	0.00062	0.00012
63	0.00015	9.88E-06	0.00063	0.00019	0.00059	0.00010	0.00062	9.32E-05
64	0.00015	9.81E-06	0.00063	0.00019	0.00058	0.00009	0.00062	7.14E-05
65	0.00014	9.73E-06	0.00064	0.00019	0.00052	0.00021	0.00061	7.28E-05
66	0.00013	9.66E-06	0.00066	0.00019	0.00054	0.00012	0.00064	1.05E-04
67	0.00013	9.58E-06	0.00066	0.00019	0.00054	0.00012	0.00059	1.65E-04
68	0.00013	9.50E-06	0.00063	0.00019	0.00051	0.00011	0.00062	1.71E-04
69	0.00013	9.44E-06	0.00062	0.00020	0.00053	0.00022	0.00061	8.33E-05
70	0.00012	9.37E-06	0.00062	0.00019	0.00051	0.00029	0.00052	1.12E-04
71	0.00012	9.30E-06	0.00060	0.00019	0.00045	0.00019	0.00052	8.30E-05
72	0.00011	9.24E-06	0.00056	0.00017	0.00039	0.00012	0.00051	9.23E-05
73	0.00010	9.20E-06	0.00054	0.00017	0.00038	9.74E-05	0.00048	9.50E-05
74	9.89E-05	9.17E-06	0.00053	0.00014	0.00037	6.10E-05	0.00045	6.29E-05
75	1.00E-04	9.15E-06	0.00052	0.00014	0.00036	4.65E-05	0.00044	9.01E-05
76	9.33E-05	9.14E-06	0.00048	0.00014	0.00036	6.07E-05	0.00043	8.24E-05
77	9.17E-05	9.11E-06	0.00048	0.00013	0.00035	6.44E-05	0.00041	3.91E-05
78	8.84E-05	9.08E-06	0.00045	0.00010	0.00038	6.22E-05	0.00041	6.62E-05
79	8.41E-05	9.07E-06	0.00043	0.00010	0.00036	7.25E-05	0.00040	4.32E-05
80	8.08E-05	9.11E-06	0.00044	0.00010	0.00035	5.74E-05	0.00041	6.79E-05
81	7.99E-05	9.11E-06	0.00048	0.00010	0.00036	5.49E-05	0.00042	5.23E-05
82	7.53E-05	9.15E-06	0.00047	0.00010	0.00039	5.43E-05	0.00041	1.08E-04
83	7.53E-05	9.20E-06	0.00047	0.00011	0.00039	8.71E-05	0.00043	6.09E-05
84	7.13E-05	9.29E-06	0.00046	0.00011	0.00034	9.05E-05	0.00042	5.97E-05
85	7.10E-05	9.43E-06	0.00048	0.00011	0.00031	1.35E-04	0.00041	6.71E-05
86	6.61E-05	9.83E-06	0.00052	0.00013	0.00028	1.15E-04	0.00041	3.26E-04
87	5.73E-05	1.02E-05	0.00056	0.00020	0.00023	1.09E-04	0.00041	1.41E-04
88	5.36E-05	1.05E-05	0.00064	0.00036	0.00022	8.11E-05	0.00029	9.68E-05
89	4.63E-05	1.10E-05	0.00093	0.00092	0.00020	7.26E-05	0.00027	1.46E-04
90	3.85E-05	1.15E-05	0.00048	0.00024	0.00014	4.20E-05	0.00028	9.56E-05
91	2.87E-05	1.18E-05	0.00098	0.00035	6.60E-05	1.71E-04	0.00024	1.72E-04
92	1.48E-05	1.25E-05	0.00091	0.00033	7.20E-05	5.63E-05	0.00017	6.39E-05
93	1.03E-05	1.30E-05	0.00098	0.00032	7.61E-05	8.94E-05	0.00018	8.70E-05
94	1.65E-06	1.34E-05	0.00095	0.00031	7.52E-05	7.69E-05	0.00023	5.71E-05
95	-1.54E-05	1.42E-05	0.00081	0.00030	7.02E-05	1.58E-04	7.44E-05	1.54E-04
96	-1.68E-05	1.50E-05	0.00038	0.00787	8.53E-05	2.56E-04	5.54E-06	1.58E-04
97	-3.25E-05	1.64E-05	0.00021	0.00032	-3.19E-05	1.12E-04	-3.17E-05	1.21E-04

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98	-4.25E-05	1.74E-05	0.00024	0.00055	3.95E-05	6.03E-05	-7.17E-05	1.22E-04
99	-5.09E-05	1.97E-05	-0.00007	0.00017	2.65E-04	2.14E-03	7.86E-05	1.94E-04

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Notes: Coefficients and standard errors on youth employment from quantile regressions (QR) and quantile instrumental variable regressions (QIV) of adult wage; QR is the procedure by [Koenker and Bassett \(1978\)](#); QIV is the procedure by [Chernozhukov and Hansen \(2005, 2006, 2008\)](#); The instruments are aggregate daily unemployment rates averaged over experience year  $t = \{2, 3, 4, 5\}$  ( $U_t$ ), or averaged over the second to fifth experience year ( $U_{2/5}$ ); In case of QR and QIV under just-identification, robust standard error calculation is based on [Powell \(1986\)](#); In case of QIV under over-identification, robust standard error calculation is based on [Chernozhukov and Hansen \(2008\)](#); All regressions include the full set of control variables; see Section 8.1 for variable definitions.

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TABLE III  
SUMMARY STATISTICS ON VARIABLES – 1987-1990\*\*\*

variable	mean	standard deviation	minimum	maximum
adult wage	4.37	0.349	-0.25	7.74
youth employment	990	458	0	1,461
youth UR (Exp.year 2-5)	9.87	1.48	7.54	12.06
age	19.59	1.71	15	29
age_sq	386.68	70.59	225	841
firm size	1142.44	5019.49	1	62869
firm wage	55.92	14.07	4.89	110.74
agricultural occ.	0.019	0.137	0	1
unskilled manual	0.093	0.290	0	1
skilled manual	0.639	0.480	0	1
technical occ.	0.027	0.163	0	1
unskilled service	0.019	0.135	0	1
skilled service	0.010	0.100	0	1
(semi)professions	0.009	0.095	0	1
unskilled commerc.	0.033	0.179	0	1
skilled commerc.	0.123	0.329	0	1
missing	0.027	0.163	0	1
agriculture	0.013	0.113	0	1
energy/mining	0.028	0.165	0	1
manufacturing	0.514	0.500	0	1
construction	0.143	0.350	0	1
trade	0.120	0.325	0	1
transport/communic.	0.045	0.207	0	1
financial intermed.	0.021	0.143	0	1
other services	0.080	0.271	0	1
non-profits	0.009	0.093	0	1
public admin.	0.027	0.161	0	1
missing	0.001	0.025	0	1
cohort 1987	0.279	0.449	0	1
cohort 1988	0.263	0.441	0	1
cohort 1989	0.237	0.425	0	1
cohort 1990	0.220	0.414	0	1
adult UR	12.82	0.440	12.2	13.45
district UR	8.52	3.47	2.4	17.4
false report	0.533	0.499	0	1

Notes: N = 17,177; For variable definitions see Section 8.1.

TABLE IV  
SUMMARY STATISTICS ON VARIABLES – 1998-2000\*\*\*

variable	mean	standard deviation	minimum	maximum
adult wage	4.26	0.422	-0.27	6.56
youth employment	935	501	0	1,461
youth UR (Exp.year 2-5)	9.95	0.531	9.4	11.33
age	20.3	1.84	15	29
age_sq	415.31	77.85	225	841
firm size	660.95	3267.96	1	48654
firm wage	77.92	19.41	3.45	144.38
agricultural occ.	0.018	0.133	0	1
unskilled manual	0.083	0.276	0	1
skilled manual	0.612	0.487	0	1
technical occ.	0.029	0.167	0	1
unskilled service	0.020	0.139	0	1
skilled service	0.012	0.108	0	1
(semi)professions	0.016	0.126	0	1
unskilled commerc.	0.026	0.158	0	1
skilled commerc.	0.151	0.359	0	1
missing	0.034	0.181	0	1
agriculture	0.014	0.117	0	1
energy/mining	0.020	0.138	0	1
manufacturing	0.440	0.496	0	1
construction	0.203	0.402	0	1
trade	0.135	0.342	0	1
transport/communic.	0.033	0.179	0	1
financial intermed.	0.016	0.125	0	1
other services	0.109	0.312	0	1
non-profits	0.011	0.104	0	1
public admin.	0.020	0.140	0	1
cohort 1998	0.354	0.478	0	1
cohort 1999	0.320	0.466	0	1
cohort 2000	0.326	0.469	0	1
adult UR	14.15	0.738	12.75	15.1
district UR	9.27	2.72	2.8	17.7
false report	0.153	0.360	0	1

Notes: N = 8,543; For variable definitions see Section 8.1.

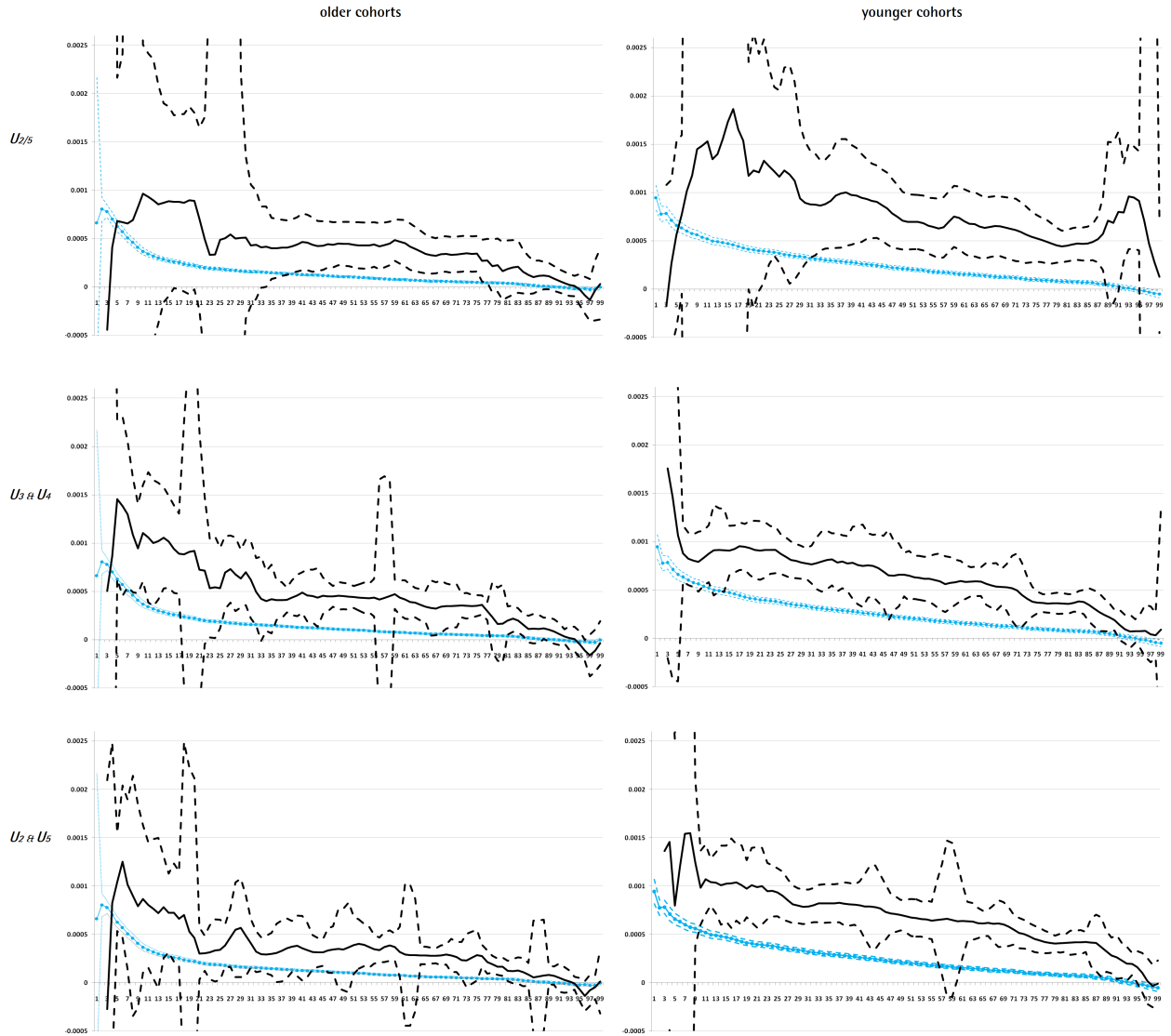


FIGURE 6.— Quantile Instrumental Variable Regression Estimates of the Returns to Early Employment Stability

Notes: Coefficients on youth employment from QR and QIV. 90% confidence intervals indicated by dotted lines. In case of QR confidence intervals were bootstrapped with 200 replications. In case of QIV inference is based on formulas in [Chernozhukov and Hansen \(2008\)](#). The implementation of the QIV procedure in Matlab is based on codes provided by Christian Hansen. Model specifications are similar to those of column (3) and (6) of Table I. For variable definitions see Section 8.1.