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Seniority in Germany: New Evidence on Returns to Tenure for Male Full-time Workers*

Robert Orłowski and Regina T. Riphahn

This study uses recent data taken from the German Socio-Economic Panel (2002–2006) to evaluate the extent of and heterogeneity in returns to tenure for men in eastern and western Germany, employed in both the private and the public sector. We find significantly different wage patterns in eastern and western Germany as well as between the private and public sectors. Irrespective of the particular subsample, the application of the Altonji-Shakotko estimation approach yields minute and insignificant returns to tenure and more substantial returns to experience. The profile of the eastern German wage structure is surprisingly flat: after the first ten years of experience – and in contrast to the situation in western Germany – there appear to be no returns to additional general human capital.

* This paper was released for publication in May 2008.

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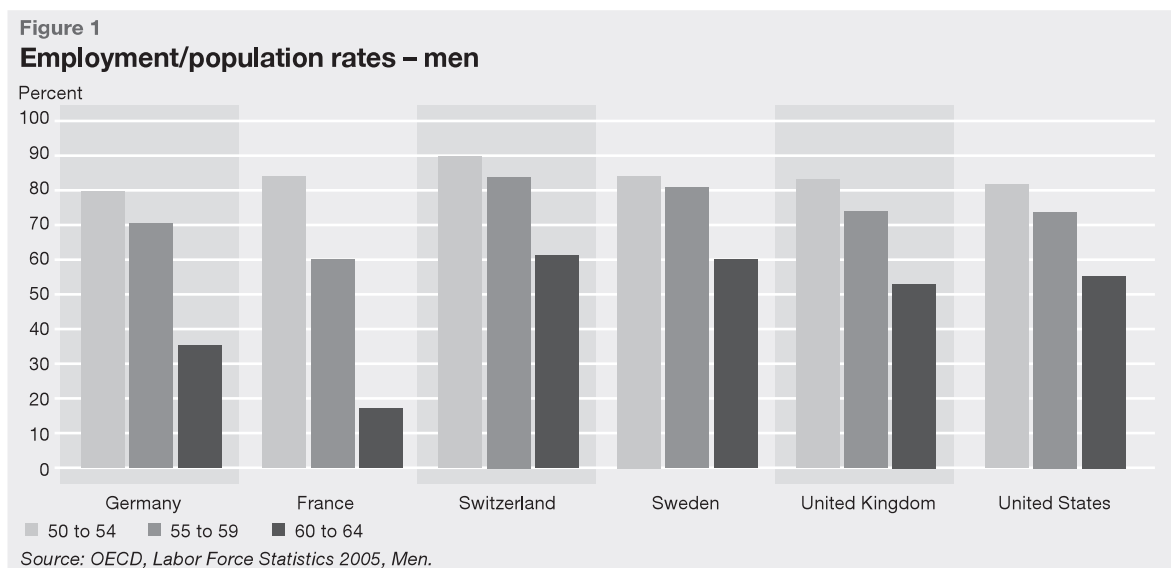
1 Introduction

In 2000 European governments agreed to raise labor force participation rates to an average of 70 percent by 2010 in order to keep pace with the economic development of dynamic economies such as the United States or Asian nations. In Germany, labor force participation is particularly subdued among older workers (for an international comparison of population employment rates among men by age group see Figure 1). In addition, German unemployment falls disproportionately on older workers even in times of rising labor force participation. Older workers suffer a major economic disadvantage in a labor market where their employment opportunities are limited and particularly when population aging imposes additional savings requirements for old age. This research asks whether poor labor market conditions for older workers in Germany might be a consequence of high returns to seniority. If older workers receive wages beyond their productivity and if, in consequence, they base their reservation wages on the experience of high earnings this might be the major culprit behind the observed labor market outcome of nonemployment among older workers. Schleife (2006) investigates whether low employment among older German workers can be explained by the increasing requirement of PC use at work. This hypothesis is rejected by the data. Instead she finds that occupational status such as self-employment is an important determinant of the labor force participation of older workers.

This investigation evaluates the most recent returns to tenure in Germany. Different arguments justify

the expectation that wages increase with time on the job. On the one hand, returns to seniority or steep age-earnings profiles may derive from a deferred compensation context (Lazear 1979). Also, returns to tenure may go back to human capital growth that is associated with both general labor market experience and firm-specific work experience, i.e. tenure. Both experience and tenure would thus generate a positively sloped age-earnings profile. The main challenge in measuring the returns to job seniority is to identify the relevant causal mechanism and to separate it from the mere sorting of workers into jobs that best match their characteristics. To account for the potential endogeneity of tenure in wage regressions we apply the meanwhile classic estimator proposed by Altonji and Shakotko (AS 1987). This frequently applied approach (for a recent example see Parent 2000) is particularly useful as a baseline approach which allows for comparisons of life-cycle wage structures across countries and labor markets.

Most of the existing literature on the German wage structure has used similar estimators or variations thereof and applied older data than evaluated here. Three studies are of key interest for our analyses: Dustmann and Meghir (2005) investigate the returns to experience and tenure for a sample of young men up to age 35 in two skill groups with West German data from 1975 through 1995. They look at displaced workers to identify the effects of interest. Conditional on returns to experience and to sector-specific human capital they find large returns to tenure of 4 and 2.5 percent *per year* in the first five years for unskilled and skilled workers respectively. Dustmann and Pereira (2005) use panel data to compare German and UK wage structures, separately for dif-



ferent education groups. Applying various estimators in the spirit of Altonji and Shakotko (1987) and using German Socio-Economic Panel (1984–1997) data on western German men aged 16–60 and working in the private sector, they find modest returns to tenure of about 2 percent in ten years.

Finally, Amann and Klein (2008) recently analyzed the wages of privately employed men in western Germany, observed from 1984 to 2003 in the German Socio-Economic Panel. These authors predict average wages to increase by about one percent per year of tenure. They point out that unobserved worker heterogeneity is a key factor and that more productive workers have flatter wage profiles.

The paper by Luchsinger et al. (2003) is closely related to these studies on German data and applies the Altonji and Shakotko (1987) as well as the Topel (1991) estimators to Swiss panel data. The authors find the two estimation approaches to yield quite different robust results: ten years of tenure are associated with a small wage increase of about 1.8 percent based on the AS procedure and about 8 percent using Topel's approach.

In contrast to the existing literature we explicitly take into account the potential heterogeneity of wage structures in different labor markets, as characterized by region or type of employer. First, we consider the eastern and western German evidence separately. Since German unification the eastern and western German labor markets have differed in a number of respects (e.g. unemployment rates, wage levels, collective bargaining coverage), which suggests that also wage structures may follow different patterns (for a description of eastern German wages see e.g. Franz and Steiner 2000).

Second, we compare the wage determinants for the private and the public sector. The two types of employment differ in many respects which altogether suggest higher returns to seniority in the public sector (cf. Dustmann and van Soest 1997): (a) in the public sector wages are explicitly set as a function of time in the job, (b) public sector employees typically receive identical rates of wage increases whereas negotiations in the private sector at times yield wage-compressing outcomes, and (c) on-the-job training and the development of specific human capital is more frequent in the public sector. The literature on the wage structure in the public sector is rather sparse. Recent contributions on the German case (Dustmann and van Soest 1998, Jürges 2002, Melly 2005 and Heitmueller and Mavromaras 2007) decompose private-public wage gaps with particular attention to the selectivity of the labor force in the

two sectors. An analysis of differential seniority and experience patterns in the public vs. private sector wages has not yet been provided so far.

The contribution of our study to this literature is threefold: first, with the GSOEP waves of 2002–2006 we use the most recent data available. Second, applying a classic estimation procedure that yields results comparable to much of the existing literature we are the first to compare the returns to tenure for the eastern and western German labor markets. Finally, we investigate wage structures for employees in the private and the public sector and – to our knowledge – provide the first analysis of the structure of public sector wages for Germany.

Our analysis yields three main results. first, the returns to tenure virtually disappear when the potential endogeneity of tenure is taken into account using the approach of Altonji and Shakotko (1987). Second, the life-cycle wage structures differ considerably between eastern and western Germany, as there appear to be no additional returns to experience after the first few years of labor market participation in eastern Germany. The eastern German wage profile is surprisingly flat and different from its western German counterpart even for young workers. Finally, wage structures hardly differ for the private and public sector in western Germany. However, we find the largest (though insignificant) returns to tenure in the public sector in eastern Germany, where returns to experience remain at the generally low eastern German level.

The paper proceeds as follows: next we describe the empirical method applied in this study. Section three presents the data, sample and variables. The estimation results are discussed in section four and the paper ends with a conclusion in section five.

2 Theory and method

The AS (Altonji/Shakotko 1987) approach to measuring the returns to tenure starts with the assumption that the log real wage (W) of individual i in job j in period t is determined by

$$W_{ijt} = b_0 X_{ijt} + b_1 T_{ijt} + b_2 T_{ijt}^2 + b_3 \text{OLDJOB}_{ijt} + e_{ijt}, \quad (1)$$

where X represents a vector of individual and job characteristics (e.g. education, labor force participation experience, marital status), T and T^2 are tenure and its square, OLDJOB indicates whether job ten-

ure is at least one year.¹ Altonji and Shakotko (1987) introduce the latter indicator in order to allow for an unrestricted wage response to passing the first year in a new job.² The b_k are coefficients to be estimated and e_{ijt} is an error term. The error term is assumed to combine fixed individual effects (e_i), fixed job-match effects (e_{ij}) and a random term η_{ijt}

$$e_{ijt} = e_i + e_{ij} + \eta_{ijt} . \quad (2)$$

The individual fixed effects (e_i) may reflect unobserved permanent characteristics of the individual worker, such as ability, motivation or characteristics that caused prior job changes. The job-match effect (e_{ij}) reflects permanent wage differences based on having person i in job j . At times, individuals are paid permanently above or below job standards, e.g. because they match the job requirements particularly well or particularly poorly.³ In addition, any job match is the (endogenous) result of both employer and employee decisions.

The OLS estimates of the parameters b_k in model (1) are unbiased only if the explanatory variables are not correlated with the composite error term. Such correlations however, are plausible for a number of reasons: (a) tenure is a function of past layoff and quit decisions, as well as of unemployment experience. Since permanent individual-specific characteristics such as ability, motivation and productivity are likely to affect such past decisions as well as current wages, tenure may well be positively correlated with e_i which would cause an upward bias in the estimated OLS tenure effect. (b) Various mechanisms may cause a correlation between tenure and e_{ij} , the job-match specific heterogeneity. On the one hand one might expect individuals with a particularly good job match to be unlikely to quit, which generates a positive correlation and an upward bias in the OLS estimator. On the other hand workers change jobs exactly when they find a new position that provides a better match than the previous employment. This implies first that all possible matches that did not cause an improvement remain unobserved and we observe only a positive selection. Second, by definition then new and improved job matches have a short job tenure,

which suggests a negative correlation between tenure and the match-specific error term. Therefore the overall correlation between tenure and e_{ij} is ambiguous. (c) Matching and search models (see e.g. Burdett 1978; Jovanovic 1979) suggest that job shopping over a career generates a positive correlation between labor force experience and match-specific unobserved heterogeneity since more experienced workers have had more time to locate advantageous jobs. In the OLS framework this generates an overestimation of the return to experience. Given the positive correlation between experience and tenure this generates a downward bias for the estimation of the returns to tenure. (d) Finally, observed labor force participation experience might be correlated with unobserved individual-specific heterogeneity as more motivated individuals may spend more time in the labor market than others.

Altonji and Shakotko (1987) suggest an instrumental variables approach to address these endogeneity problems. In a first step they address the endogeneity of tenure due to the correlation with individual (e_i) and match-specific heterogeneity (e_{ij}). For each of the three tenure indicators they calculate as an instrument the difference between the period-specific value and its average value \bar{T}_{ij} for a given job match j of person i :

$$\hat{T}_{ijt} = T_{ijt} - \bar{T}_{ij} . \quad (3)$$

This indicator is correlated with T and by construction uncorrelated with e_{ij} and with e_i and therefore provides a valid instrument that takes into account the first two of the four potential biases discussed. We follow this approach to instrument the job tenure indicators (IV1). As this estimator may underestimate the returns to tenure due to the endogeneity of the experience variable, we follow Altonji and Shakotko (1987) (and Parent 2000) in additionally considering an instrumental variables solution to this problem. While the tenure variables are instrumented with deviations from job-match means, experience is instrumented with its deviations from individual means (IV2). This takes account of the correlation of experience with e_i .

While these estimation procedures are standard in the literature they have some disadvantages. First, although the considered instruments for experience have desirable properties, they do not take into account the potential bias deriving from the potential correlation between experience and job-match-specific heterogeneity. To the extent that this generates an overestimate of the returns to experience, the returns to seniority may only provide lower bounds. However, Altonji and Shakotko (1987) point out

¹ Parent (2000) uses the same specification.

² In a similar spirit, Amann and Klein (2008) choose to omit entirely observations with less than one year of tenure to reduce measurement error on the dependent variable in the first year of tenure. We follow the approach of Altonji and Shakotko (1987) and allow for a discontinuity in the tenure effect after the first year.

³ Other studies consider industry-specific effects in the error term (see e.g. Dustmann and Meghir 2005; Parent 2000). We allow for systematic differences at industry level by controlling for industry fixed effects.

that the larger the share of job changes that is determined by exogenous factors such as firm closures which are not correlated with e_{ij} the smaller the bias. Second, following Altonji and Shakotko (1987) and Parent (2000) we assume the job-match-specific heterogeneity to be time-invariant. A correlation between tenure and a time-varying match-specific error component could generate an a priori indeterminate bias. A final concern, which we share with all studies in this field of literature is the possibility of downwardly biased estimates due to measurement error in the tenure and experience measures. Below we describe how our variables are generated in an effort to minimize measurement error.

An alternative and commonly used estimation approach with similar identifying restrictions is that proposed by Topel (1991). He applies a two-step procedure. The first step generates a consistent estimator of the joint returns to tenure and experience based on a first difference estimation of wages which eliminates individual-specific and job-match-specific error terms. In a second step he identifies the returns to experience based on a cross-section of workers starting a new job. Similar to Altonji and Shakotko (1987), Topel (1991) assumes that individual-specific and job-match-specific error terms are constant over time and disappear when using first differences in wages. Under the additional assumption that experience and person-specific unobserved heterogeneity are uncorrelated when a new job is started, this allows for a consistent estimate of the returns to tenure and education. Topel (1991) analytically derives the difference in the two estimation approaches in terms of the bias in Altonji and Shakotko's instrumental variables estimator, which intuitively derives from the different instruments applied in the two approaches: while Topel uses wage changes, Altonji and Shakotko (1987) apply deviations from means.

The idea of eliminating non-time-varying unobservables by estimating fixed differences is applied by Topel and Ward (1992), as well. These authors focus on modeling job mobility as a function of tenure, experience and wages. Unfortunately, they do not identify the effects of tenure and experience separately in their characterization of wage growth. However, they show for the U.S. birth cohorts 1938–1941 that wage growth early in the career is substantially affected by job mobility. As the authors endogenize mobility and thus tenure, the study implicitly suggests a more complex approach to identifying the returns to tenure. An estimation framework taking these relationships into account is e.g. Dustman and Meghir (2005). We follow the classical framework suggested by Altonji and Shakotko,

which identifies the returns to tenure within the limits of the assumptions discussed above.

We present results based on three estimators. First, OLS results are presented with two alternative model specifications. Standard errors are clustered at the individual level to adjust flexibly for any random effects or heterogeneity structure in the unobservables. Second, we apply the classic AS estimator where tenure variables are instrumented and standard errors are adjusted using a random effects procedure (IV1, again two alternative model specifications are presented). The third estimator repeats the procedure of the second one, only now instrumenting both the tenure as well as the experience variables (IV2).

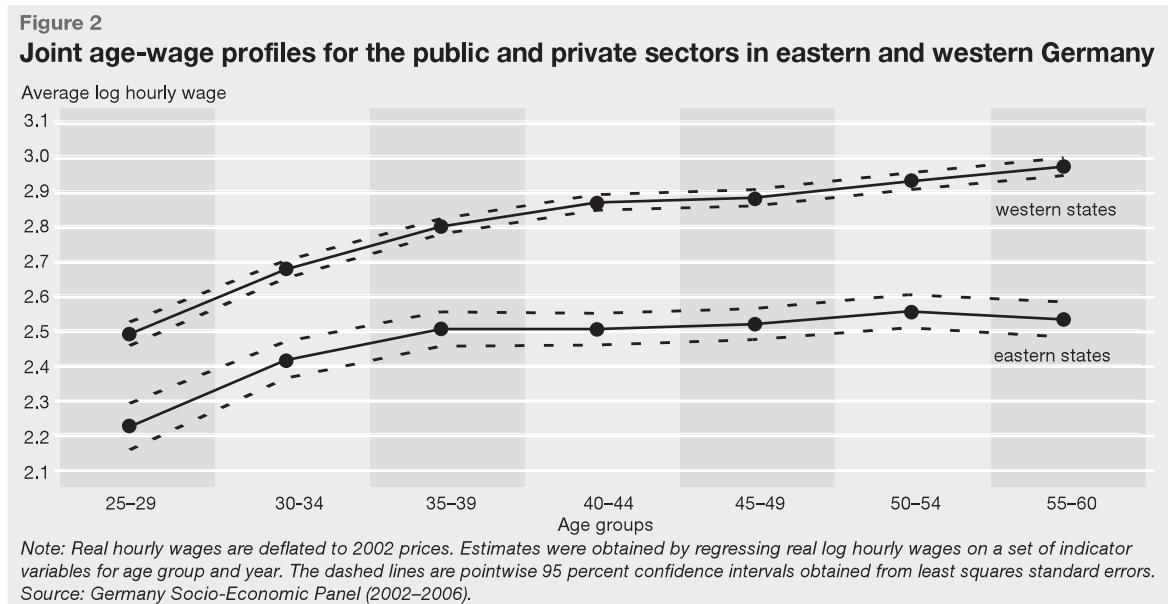
3 Data

We use the German Socio-Economic Panel (SOEP Group 2001), which has collected annual information on demographic and economic circumstances of individuals and households since 1984. We study the most recent developments and use annual data from 2002 to 2006. The 2002 wave covers 23,892 individuals in 12,692 households with similar sample sizes in subsequent years.⁴

Our sample consists of the male population, aged 25 to 60, in full-time employment, i.e. with a contract for at least 35 working hours per week. Workers are excluded if they are self-employed, in vocational training, in marginal jobs or if they are in special protected employment for the disabled. In order to apply the AS estimator we consider only individuals who are observed for at least two subsequent years. We observe individuals in on-going employment relationships and censor observations on job matches when a given employment relationship is interrupted. Individuals who change jobs over the course of our data can reappear in the sample. Contrary to most of the literature we consider individuals employed in the private and in the public sector separately. More than half of our workers are observed for the full period of our data, about 15 percent are observed for 3 and for 4 years each, and one fifth is available for only two subsequent observation periods.

The GSOEP measure of labor force participation experience gives the number of years an individual has worked full time up to the time of the interview

⁴ Some of the advantages of the GSOEP data compared to datasets based on the unemployment insurance registers are that it provides a richer set of background variables, an uncensored dependent variable, information on hourly wages, and a sample that is representative of the entire population.



combining biographical and annually collected data. Following Altonji and Shakotko (1987) we measure tenure as the time an individual was employed with the same employer, even if the precise job description may have changed. We excluded all cases in which the reported number of years of experience was below the reported current tenure, as we cannot determine which of the variables is coded erroneously. After omitting observations with missing values on the dependent variable, our final sample contains 3,706 individuals with 14,625 person years.⁵ Of these workers 23.7 percent live in eastern Germany and a share of 22 percent is employed in the public sector.

Our dependent variable is the log of hourly wages, deflated to prices of 2002 by the annual consumer price index. Log hourly wages are generated from gross monthly incomes, which we divided by the *current* hours worked in the month of the interview. We use current working hours because monthly income includes overtime pay and thus likely responds to actual hours worked. We use contracted hours only in cases of missing information on actual hours worked. On average, males work 44.6 hours per week compared to 39.1 hours of contracted time. In our sample, the mean of the log gross hourly wage is 2.74 or 15.49 Euros.⁶ Figure 2 depicts the average development of log real gross hourly wages over the

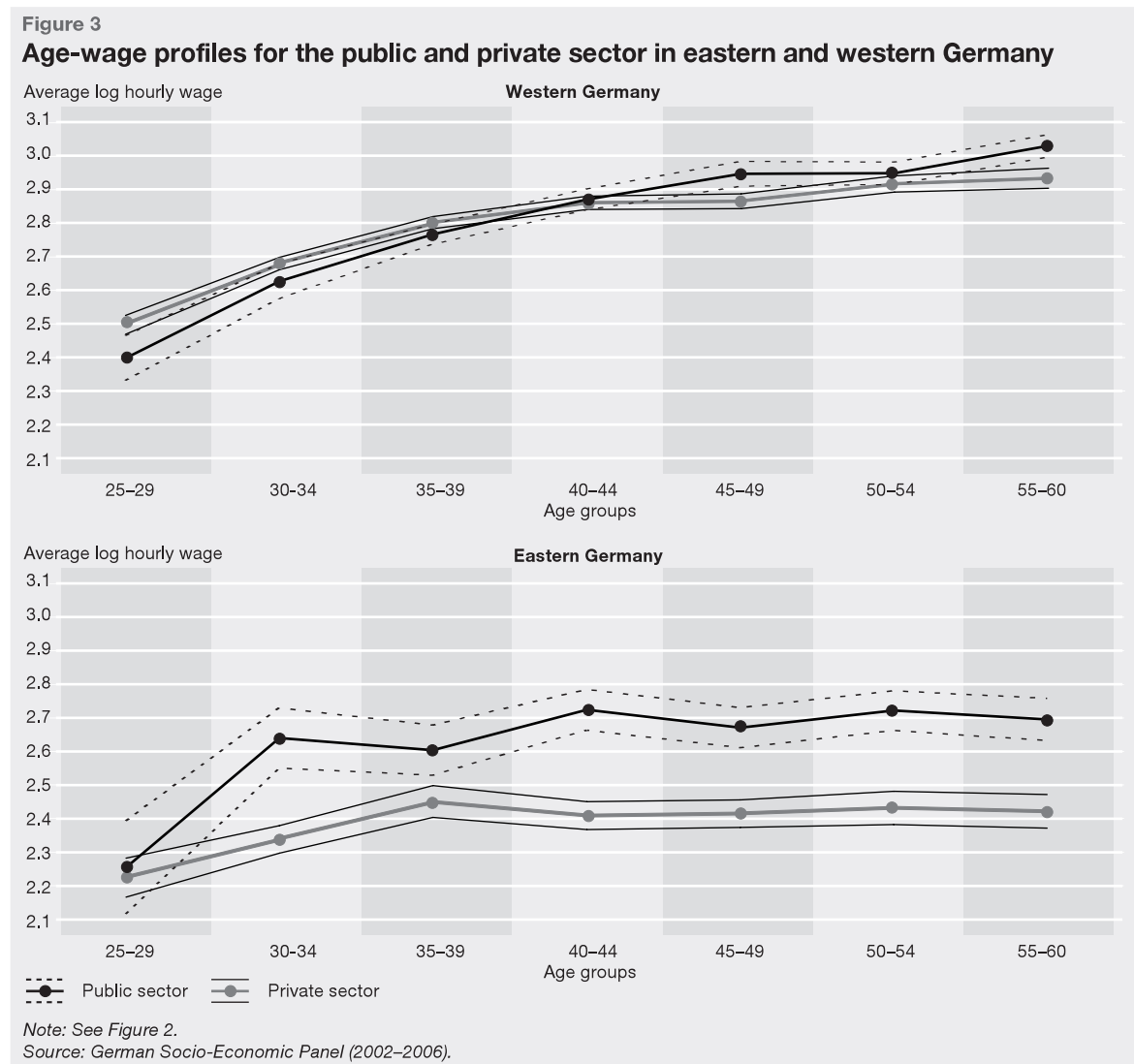
life-cycle.⁷ The wages in western Germany are substantially higher than those in the East and the age profile seems to be more pronounced in western than in eastern Germany. Figure 3 depicts the life-cycle wage profiles separately for workers in the public and the private sector in eastern and western Germany. While the selection of workers into sectors of employment is not random as discussed by Dustmann and van Soest (1998), at a descriptive level it is interesting to see first that wage profiles in western Germany run above those in eastern Germany for both sectors, second that the life-cycle wage structure in the western German private sector does not differ significantly from that of the public sector, third that the public sector pays higher real hourly wages in eastern Germany, and finally that the rising slope in western German life-cycle wages is not matched by eastern German developments. In eastern Germany we find rather flat wage developments after age 40. None of the observed patterns matches those predicted by Dustmann and van Soest (1998: 1429), who find increasing wages in the public sector and a concave and downward sloping age-wage profile for the private sector.

At each interview, individuals were asked whether and when they started a new job thus providing precise monthly information on tenure and experience. This contrasts with the measurement errors faced for example by Altonji and Shakotko (1987). In our

⁵ Jointly the two conditions of experience not having a lower value than tenure and non-missing wages reduce the sample size considerably by about 27 percent, more than 75 percent of which is due to the poorly coded experience variable.

⁶ For four percent of our observations missing values for gross income were imputed based on net income information, marital status and the number of children.

⁷ In the alternative dataset for the analysis of German wages, the *IAB Employment Sample (IAB Beschäftigtenstichprobe)*, which is applied e.g. by Dustmann and Meghir (2005), more than 20 percent of western Germans in the age groups above 50 and more than 10 percent of eastern Germans in the age groups above 45 would be censored due to top-coding of the data.



sample individuals have an average of 10.5 years of tenure and 20.5 years of general labor market experience.

By international comparison and as discussed in other studies (e.g. Dustmann and Pereira 2005), German job mobility is rather low. Table 1 shows that less than one quarter of all employees changed their job (excluding intra-firm changes) during the five-year period considered here. Nineteen percent changed their job once and approximately five percent changed their job more than once. Since firm-specific human capital is not lost when changing positions within a given firm, we define job changes as changes of employer.

Regarding the set of explanatory variables we closely follow Altonji and Shakotko (1987) (cf. their Table 1) and consider the level of education measured as years of schooling and its square. An in-

teraction term between experience and education captures the fact that individuals with higher education have had less opportunity to acquire work ex-

Table 1
Frequency of job changes

| Number of job changes | Frequency | Percent |
|-----------------------|-----------|---------|
| 0 | 2,797 | 75.47 |
| 1 | 709 | 19.13 |
| 2 | 174 | 4.70 |
| 3 | 23 | 0.62 |
| 4 | 3 | 0.08 |
| Total | 3,706 | 100 |

Note: Intra-firm job changes are not considered.
 Source: German Socio-Economic Panel (2002–2006).

Table 2
Descriptive statistics for full sample and subsamples

| Variable | Germany | Eastern Germany | Western Germany | Public sector | Private sector |
|--------------------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| monthly gross income (in Euro) | 3,352.01 (15.70) | 2,624.94 (24.10) | 3,574.10 (18.63) | 3,419.34 (28.87) | 3,342.66 (18.59) |
| log of hourly wage | 2.7498 (0.0037) | 2.4881 (0.0077) | 2.8298 (0.0039) | 2.8187 (0.0069) | 2.7336 (0.0043) |
| weekly hours worked | 44.61 (0.0615) | 45.48 (0.1246) | 44.35 (0.0705) | 43.78 (0.1256) | 44.85 (0.0710) |
| age | 43.28 (0.0724) | 43.89 (0.1503) | 43.10 (0.0825) | 45.13 (0.1576) | 42.86 (0.0817) |
| education (in years) | 12.63 (0.0234) | 13.00 (0.0451) | 12.52 (0.0272) | 13.62 (0.0562) | 12.38 (0.0254) |
| tenure (in years) | 10.54 (0.0707) | 8.66 (0.1173) | 11.13 (0.0843) | 13.22 (0.1661) | 9.87 (0.0775) |
| experience (in years) | 20.46 (0.0792) | 21.06 (0.1592) | 20.28 (0.0911) | 21.59 (0.1748) | 20.22 (0.0896) |
| job change (inter firm) | 0.3071 (0.0098) | 0.3603 (0.0215) | 0.2906 (0.0109) | 0.1762 (0.0169) | 0.3451 (0.0117) |
| Number of observations | 14,625 | 3,422 | 11,203 | 3,047 | 11,310 |

Note: The table presents the variable means and standard deviations by subsample.

Source: German Socio-Economic Panel (2002–2006).

perience. A large set of indicators controls for additional demographic and economic effects. We consider marital status (5), state of residence (15), industry (11), firm size (6), calendar year (5), whether an individual works abroad or in eastern Germany, and whether a person was born in Germany. Descriptive statistics on our main explanatory variables are presented in Table 2 for the various subsamples. Employees in eastern and western Germany differ in terms of wage levels and the much shorter tenure in eastern than in western German jobs. Surprisingly, the wage levels in private and public-sector employment are rather similar. As one might expect, employment in the public sector is much more stable, which results in an average tenure that is more than three years longer. The other explanatory variables are described in Appendix Table A1 for the full sample and the subsamples. It is interesting to note that the share of employees in the public sector is substantially larger in eastern than in western Germany.

4 Results

We estimate the wage model as presented in equation (1) using two specifications⁸ and three estima-

⁸ One of the specifications is an extensive one, the other considers a reduced set of explanatory variables.

tors (OLS and two difference IV-estimators) for different samples and subsamples to study recent patterns of the German wage structure. The estimation results for our main model are presented in Table 3 for employees in the private sector in western Germany and in Table 4 for those in the eastern German private sector. In both cases, Panel A presents the coefficient estimates and standard errors, and Panel B illustrates the predicted wage effects of changes in tenure and experience.⁹

Columns 1 and 2 of Table 3 provide the results of OLS regressions for the western German sample. The full model yields a good fit to the data and explains 45 percent of the variation in log wages. We find highly significant coefficient estimates for most of the variable groups. They indicate large positive associations of wages with education, with being born in Germany, working in a large firm, and with observations of more recent years. The simulations in Panel B show considerable returns to tenure of ($\exp(0.1217) - 1 =$) 13 percent and returns to experience of 25 percent after the first ten years of employment. Once we instrument the tenure variables applying the AS estimator, the predicted returns to

⁹ We do not present first stage regression results because of their large number. They are available from the authors upon request and indicate that the instruments are highly and significantly correlated with the endogenous covariates.

Table 3

**Estimation (A) and prediction (B) results:
log real hourly wages in the private sector, western Germany (2002–2006)**

| | (1) (OLS) | (2) (OLS) | (3) (IV1) | (4) (IV1) | (5) (IV2) |
|------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Panel A | | | | | |
| Education | -0.00197 [0.02175] | -0.00211 [0.02178] | 0.00821 [0.02179] | 0.00792 [0.02157] | 0.08653* [0.04452] |
| Education ² /100 | 0.18878** [0.07797] | 0.18934** [0.07807] | 0.18645** [0.07693] | 0.18718** [0.07613] | 0.06841 [0.15721] |
| Experience | 0.01753** [0.00776] | 0.01828** [0.00773] | 0.03295*** [0.00644] | 0.03289*** [0.00641] | 0.10248*** [0.01662] |
| Experience ² /10 | -0.01179*** [0.00336] | -0.01225*** [0.00334] | -0.01332*** [0.00267] | -0.01344*** [0.00266] | -0.01341*** [0.00319] |
| Experience ³ /100 | 0.00156*** [0.00052] | 0.00163*** [0.00051] | 0.00140*** [0.00041] | 0.00143*** [0.00041] | 0.00110** [0.00048] |
| Educ.*Exp. | 0.00119*** [0.00026] | 0.00119*** [0.00026] | 0.00073*** [0.00023] | 0.00075*** [0.00023] | -0.00270*** [0.00057] |
| Tenure | 0.01111*** [0.00276] | 0.01234*** [0.00259] | -0.00158 [0.00273] | -0.00108 [0.00243] | -0.00356 [0.00236] |
| Tenure ² /10 | -0.00159* [0.00091] | -0.00192** [0.00088] | 0.00242** [0.00107] | 0.00229** [0.00100] | 0.00256*** [0.00090] |
| Tenure >1 | 0.02642 [0.01762] | – | 0.00391 [0.01018] | – | 0.00903 [0.00888] |
| Born in Germany | 0.12622*** [0.01604] | 0.12610*** [0.01604] | 0.07985*** [0.01351] | -0.08108*** [0.01343] | 0.00705*** [0.01785] |
| Single | -0.07638*** [0.01792] | -0.07666*** [0.01792] | -0.04284*** [0.01412] | -0.04374*** [0.01405] | 0.02769 [0.01966] |
| Widowed | 0.00834 [0.06248] | 0.00748 [0.06264] | 0.06104 [0.05383] | 0.06043 [0.05374] | 0.05784 [0.05713] |
| Divorced | -0.07902*** [0.02440] | -0.07943*** [0.02441] | -0.05648*** [0.01673] | -0.05677*** [0.01670] | -0.04811*** [0.01835] |
| Separated | -0.04706 [0.03328] | -0.04711 [0.03336] | -0.02186 [0.01890] | -0.02218 [0.01892] | -0.01184 [0.01817] |
| Workplace (East) | 0.00937 [0.04160] | 0.00763 [0.04148] | -0.06081*** [0.02277] | -0.06093*** [0.02283] | -0.06026*** [0.02064] |
| Workplace (Abroad) | -0.02755 [0.06552] | -0.02836 [0.06538] | -0.01998 [0.03735] | -0.02026 [0.03741] | -0.00946 [0.03547] |
| Firm size < 5 | -0.31231*** [0.03087] | -0.31249*** [0.03096] | -0.20693*** [0.02120] | -0.20932*** [0.02119] | -0.06712*** [0.02263] |
| Firm size 5–19 | -0.25059*** [0.02050] | -0.25065*** [0.02053] | -0.14594*** [0.01472] | -0.14797*** [0.01470] | -0.02566 [0.01634] |
| Firm size 20–99 | -0.17082*** [0.01831] | -0.17041*** [0.01830] | -0.09664*** [0.01295] | -0.09816*** [0.01293] | -0.00399 [0.01438] |
| Firm size 100–199 | -0.10364*** [0.02274] | -0.10295*** [0.02273] | -0.06269*** [0.01402] | -0.06343*** [0.01402] | -0.01003 [0.01452] |
| Firm size 200–1999 | -0.06377*** [0.01539] | -0.06347*** [0.01539] | -0.03422*** [0.01044] | -0.03460*** [0.01044] | -0.00862 [0.01063] |
| Constant | 2.08582*** [0.16091] | 2.10057*** [0.16095] | 1.92529*** [0.16198] | 1.92911*** [0.16041] | 0.67306 [0.42629] |
| Observations | 8511 | 8511 | 8511 | 8511 | 8511 |
| R ² | 0.45 | 0.45 | | | |
| Panel B | | | | | |
| 10 vs. 0 yrs Tenure | 0.12166*** (0.01205) | 0.10422*** (0.00866) | 0.01238 (0.02220) | 0.01213 (0.02249) | -0.00094 (0.02126) |
| 10 vs. 0 yrs Experience | 0.22355*** (0.02136) | 0.22734*** (0.02135) | 0.30309*** (0.02419) | 0.30295*** (0.02425) | 0.56054*** (0.08397) |
| 30 vs. 0 yrs Experience | 0.33697*** (0.02204) | 0.33906*** (0.02198) | 0.44735*** (0.03292) | 0.44575*** (0.03183) | 1.13995*** (0.21088) |

Note: All of the models additionally control for sets of 8 state indicators, 4 year indicators, and 10 industry indicators, which we do not present to save space. Standard errors are presented in parentheses. Those in columns 1 and 2 are robust and clustered at the person-level. Those in columns 3–5 use the two-stage least squares random effects estimator based on Balestra and Varadhanjan-Krishnakumar (1987), as implemented in the G2SLS option of Stata 10's *xtivreg* procedure.

***, ** and * indicate statistical significance at the 1, 5, and 10 percent levels respectively. Panel A presents the estimated coefficients and Panel B presents the predicted change in log real hourly wages when the value of the explanatory variables is changed as indicated. Standard errors in Panel B are bootstrapped. The estimations use 8,511 person-year observations for 2,254 different workers.

Table 4

**Estimation (A) and prediction (B) results:
log real hourly wages in the private sector eastern Germany (2002–2006)**

| | (1) (OLS) | (2) (OLS) | (3) (IV1) | (4) (IV1) | (5) (IV2) |
|------------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Panel A | | | | | |
| Education | 0.08279 [0.07741] | 0.08156 [0.07755] | 0.00661 [0.19174] | 0.05179 [0.16383] | 0.23287 [0.15597] |
| Education ² /100 | -0.08383 [0.26543] | -0.07946 [0.26585] | 0.08564 [0.63916] | -0.03758 [0.55682] | -0.63086 [0.53378] |
| Experience | 0.02588 [0.01725] | 0.02671 [0.01733] | -0.00069 [0.01844] | -0.00069 [0.01729] | 0.06847*** [0.02618] |
| Experience ² /10 | -0.01343* [0.00758] | -0.01397* [0.00762] | -0.00444 [0.00608] | -0.00525 [0.00604] | -0.00717 [0.00668] |
| Experience ³ /100 | 0.00183 [0.00116] | 0.00193* [0.00117] | 0.00030 [0.00094] | 0.00044 [0.00093] | 0.00063 [0.00103] |
| Educ.*Exp. | 0.00018 [0.00058] | 0.00018 [0.00058] | 0.00173* [0.00094] | 0.00158* [0.00089] | 0.00194* [0.00117] |
| Tenure | 0.01487*** [0.00516] | 0.01805*** [0.00479] | 0.00447 [0.00445] | 0.00671* [0.00389] | 0.00238 [0.00486] |
| Tenure ² /10 | -0.00343** [0.00157] | -0.00433*** [0.00148] | -0.00309 [0.00225] | -0.00378* [0.00214] | -0.00294 [0.00245] |
| Tenure >1 | 0.05388 [0.03511] | – | 0.01454 [0.01523] | – | 0.01263 [0.01655] |
| Born in Germany | 0.35873*** [0.10951] | 0.35704*** [0.10951] | 0.02721 [0.11225] | 0.03977 [0.10992] | -0.00892 [0.11548] |
| Single | -0.03240 [0.03956] | -0.03100 [0.03971] | -0.15268*** [0.04085] | -0.14595*** [0.04016] | 0.04090 [0.05920] |
| Widowed | -0.11233 [0.07544] | -0.10589 [0.07643] | 0.17790 [0.12463] | 0.16675 [0.12221] | 0.06776 [0.12838] |
| Divorced | 0.00786 [0.04419] | 0.00815 [0.04440] | 0.02343 [0.04263] | 0.02466 [0.04217] | 0.03990 [0.04465] |
| Separated | 0.05147 [0.08775] | 0.05074 [0.08846] | 0.05733 [0.03951] | 0.05839 [0.03931] | 0.07825* [0.04227] |
| Workplace (West) | 0.13966*** [0.02802] | 0.13891*** [0.02808] | 0.04226** [0.01800] | 0.04297** [0.01800] | 0.03864** [0.01934] |
| Workplace (Abroad) | 0.31551 [0.20123] | 0.31468 [0.20631] | 0.04520 [0.07055] | 0.04218 [0.07058] | 0.02754 [0.07593] |
| Firm size < 5 | -0.39539*** [0.05884] | -0.39672*** [0.05902] | -0.18859*** [0.04347] | -0.19661*** [0.04324] | -0.21390*** [0.04604] |
| Firm size 5–19 | -0.35798*** [0.04448] | -0.35777*** [0.04454] | -0.16264*** [0.03423] | -0.16850*** [0.03404] | -0.19056*** [0.03624] |
| Firm size 20–99 | -0.27877*** [0.03866] | -0.27861*** [0.03867] | -0.13854*** [0.02978] | -0.14126*** [0.02965] | -0.15306*** [0.03158] |
| Firm size 100–199 | -0.15695*** [0.04406] | -0.15796*** [0.04413] | -0.08854*** [0.03111] | -0.08958*** [0.03104] | -0.09956*** [0.03316] |
| Firm size 200–1999 | -0.04488 [0.04168] | -0.04553 [0.04170] | -0.04131 [0.02748] | -0.04204 [0.02749] | -0.04896* [0.02943] |
| Constant | 1.22323** [0.58406] | 1.25494** [0.58579] | 1.91507 [1.42884] | 1.59302 [1.19972] | -0.91590 [1.23563] |
| Observation | 2,413 | 2,413 | 2,413 | 2,413 | 2,413 |
| R ² | 0.44 | 0.44 | | | |
| Panel B | | | | | |
| 10 vs. 0 yrs Tenure | 0.16749*** (0.02566) | 0.13754*** (0.02050) | 0.02995 (0.04858) | 0.03110 (0.04891) | 0.00932 (0.05168) |
| 10 vs. 0 yrs Experience | 0.16467** (0.06487) | 0.16901** (0.06579) | 0.15345* (0.08943) | 0.14182 (0.46776) | 0.77370 (0.55768) |
| 30 vs. 0 yrs Experience | 0.12810* (0.06774) | 0.13146* (0.06870) | 0.25457 (0.23131) | 0.20284 (1.39362) | 2.02970 (1.69524) |

Note: All of the models additionally control for sets of 5 state indicators, 4 year indicators, and 10 industry indicators, which we do not present to save space. Standard errors are presented in parentheses. Those in columns 1 and 2 are robust and clustered at the person-level. Those in columns 3–5 use the two-stage least squares random effects estimator based on Balestra and Varadharanjan-Krishnakumar (1987), as implemented in the G2SLS option of Stata 10's *xivreg* procedure.

***, ** and * indicate statistical significance at the 1, 5, and 10 percent levels respectively. Panel A presents the estimated coefficients and Panel B presents the predicted change in log real hourly wages when the value of the explanatory variables is changed as indicated. Standard errors in Panel B are bootstrapped. The estimations use 2,413 person-year observations for 674 different workers.

Source: German Socio-Economic Panel (2002–2006).

tenure disappear almost completely (cf. columns 3 and 4 of Table 3). The predicted wage effect of the first ten years of tenure drops to about one percent and is no longer significantly different from zero. This suggests that the high and significant returns to tenure mainly have their root in the selection into high tenure where individuals with above average match-specific wages stay in the job longer. Instead, the returns to experience increase to a highly significant level of more than 35 percent. In column 5 we present the results of the estimation model where both tenure and experience variables are instrumented. The general pattern is confirmed, tenure does not appear to affect wages at all, whereas returns to labor force participation experience are the main determinants of wage growth over time.

These results can be compared to those obtained by Dustmann and Pereira (2005) for German men aged 16–60 in the private sector. Their specification does not control for firm size, state and industry differences, for the region of work, country of birth, or the education-experience interaction. On the other hand, they consider higher (i.e. fourth) order polynomials in tenure and experience than our model. With GSOEP data from 1984 through 1997 they obtain similarly small predicted log returns to the first ten years of tenure of 0.0803 based on OLS, an insignificant value of 0.0224 for the IV1 estimate and also negative values when both tenure and experience are instrumented. Their returns to experience are of the same order of magnitude as ours. These authors argue that in Germany returns to individual experience may be small because wage negotiations establish economy-wide wage trends rather than steep individual experience profiles. Our finding of large and significant positive year effects on wages seems to confirm their argument.¹⁰

Next, we investigate the wage structure of private sector employment in eastern Germany (see Table 4), which to our knowledge has not been looked at in the literature so far. Our sample here contains repeated observations on 675 different individuals. Again, the OLS estimation explains a substantial share of the variation in the dependent variable. Most likely due to the relatively smaller number of observations, the standard errors are larger than those for the western German sample in Table 3. We find a substantial positive association of wages with birth in Germany, with large firm size, and with more recent observation years.

The predicted effects of tenure and experience show somewhat different patterns for the eastern com-

pared to the western German sample. Both in the OLS as well as in the IV1 estimations the predicted tenure effect is – though imprecisely estimated – larger in eastern than in western Germany. Based on the predictions in columns 1–4 the returns to experience are substantially higher in western than in eastern Germany. Only the predicted experience effect in the IV2 estimation is larger in eastern Germany. However, the large eastern German effect is insignificant, whereas the western German effect is highly significant at the one percent level.

One might suspect that the results in Tables 3 and 4 are affected by potentially endogenous explanatory variables in our specification, such as firm size, an individual's place of work, or industry. In order to test whether these control variables influence the predicted returns to tenure and experience we reestimated the models in Tables 3 and 4 without these potentially endogenous covariates. The newly predicted tenure and experience effects are summarized in Table 5. While some of the predicted effects differ slightly from those observed before, the general pattern is confirmed: the returns to tenure drop to close to zero as soon as the tenure variables are instrumented. The returns to experience are substantial and grow even larger in column 5 where the experience variables are instrumented as well. Again they are larger in western than in eastern Germany especially when predicting the returns to 30 years of experience. The predicted effects of 30 years of labor market experience in eastern Germany hardly exceed the returns to ten years experience. Only when experience is instrumented itself (see column 5), does the prediction generate a substantially larger return to 30 than to ten years of experience in eastern Germany. However, even then the effect is well below that predicted for western Germany.

This intriguing finding of a flat wage-experience profile in eastern Germany demands an explanation. One possible reason why the returns to labor market experience differ between eastern and western Germany relates to the recent history of eastern Germany's labor market. After reunification most eastern German employment relationships underwent drastic changes. It is plausible to expect that the value of labor market experience that was gathered previously in the former German Democratic Republic suddenly depreciated when the market economy was introduced. In order to test whether this historical background matters, we reestimated our wage models now only considering those individuals in eastern and western Germany who were born in 1970 or later, and who thus typically entered the labor force after unification.

¹⁰ The estimation results are not presented to save space but are available from the authors upon request.

Table 5

**Prediction results – based on reduced specification:
effects on log real hourly wages in the private sector in western and eastern Germany
(2002–2006)**

| | (1) (OLS) | (2) (OLS) | (3) (IV1) | (4) (IV1) | (5) (IV2) |
|---------------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| PANEL A: western Germany | | | | | |
| 10 vs. 0 yrs Tenure | 0.16864*** (0.01908) | 0.14789*** (0.01166) | 0.01561 (0.02449) | 0.01436 (0.02418) | 0.00417 (0.02488) |
| 10 vs. 0 yrs Experience | 0.21731*** (0.02224) | 0.22160*** (0.02222) | 0.31214*** (0.03762) | 0.31212*** (0.03603) | 0.93594*** (0.13313) |
| 30 vs. 0 yrs Experience | 0.30836*** (0.02271) | 0.31056*** (0.02249) | 0.47652*** (0.05163) | 0.47300*** (0.04563) | 2.38533*** (0.37741) |
| PANEL B: eastern Germany | | | | | |
| 10 vs. 0 yrs Tenure | 0.18479*** (0.02941) | 0.17220*** (0.02136) | 0.00704 (0.03982) | 0.00640 (0.03894) | -0.01383 (0.04220) |
| 10 vs. 0 yrs Experience | 0.20252*** (0.06491) | 0.20409*** (0.06495) | 0.24306*** (0.07043) | 0.24179*** (0.08034) | 0.52398 (0.61542) |
| 30 vs. 0 yrs Experience | 0.09518 (0.06403) | 0.09625 (0.06389) | 0.25998*** (0.07721) | 0.25960** (0.12977) | 1.08151 (1.85008) |

Note: ***, ** and * indicate statistical significance at the 1, 5, and 10 percent levels respectively. Standard errors are bootstrapped. In contrast to the models presented in Tables 3 and 4 the estimations behind the predicted effects do not control for sets firm size effects (5), place of work (2) or industry (10). The entries present the predicted change in log real hourly wages when the value of the explanatory variables is changed as indicated. The estimations in Panel A on western Germany use 8,679 person-year observations for 2,275 different workers, those in Panel B on eastern Germany use 2,475 person-year observations for 679 different workers.

Source: German Socio-Economic Panel (2002–2006).

Table 6

**Prediction results – based on estimations of the full specification for birth cohorts since 1970:
effects on log real hourly wages in the private sector in western and eastern Germany
(2002–2006)**

| | (1) (OLS) | (2) (OLS) | (3) (IV1) | (4) (IV1) | (5) (IV2) |
|---------------------------------|-------------------------|-------------------------|-----------------------|------------------------|-----------------------|
| PANEL A: western Germany | | | | | |
| 10 vs. 0 years Tenure | 0.13980*** (0.02956) | 0.14553*** (0.02863) | 0.07759 (0.05779) | 0.07510 (0.05789) | 0.07060 (0.06154) |
| 10 vs. 0 years Experience | 0.45083*** (0.06327) | 0.44186*** (0.06207) | 0.39932* (0.22507) | 0.38516** (0.17870) | 0.48879 (0.61181) |
| PANEL B: eastern Germany | | | | | |
| 10 vs. 0 years Tenure | 0.25610*** (0.06619) | 0.23695*** (0.06204) | 0.02060 (0.16592) | 0.01518 (0.16870) | -0.02801 (0.20316) |
| 10 vs. 0 years Experience | 0.19176 (0.24256) | 0.20676 (0.23955) | 0.18407 (0.54983) | 0.19629 (0.59972) | 1.77223 (1.20539) |

Note: Bootstrapped standard errors are presented in parentheses. ***, ** and * indicate statistical significance at the 1, 5, and 10 percent levels respectively. The entries present the predicted change in log real hourly wages when the value of the explanatory variables is changed as indicated. The estimations for western Germany use 1,537 person-year observations for 444 different workers, those for eastern Germany use 416 person-year observations for 132 different workers.

Source: German Socio-Economic Panel (2002–2006).

Table 7

**Prediction results – based on full and reduced specification:
effects on log real hourly wages in the public sector in western and eastern Germany
(2002–2006)**

| | (1) (OLS) | (2) (OLS) | (3) (IV1) | (4) (IV1) | (5) (IV2) |
|---|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|
| PANEL A: western Germany – full specification | | | | | |
| 10 vs. 0 yrs Tenure | 0.19366*** (0.04614) | 0.12279*** (0.02159) | -0.05988 (0.13777) | -0.07266 (0.13553) | -0.07959 (0.13676) |
| 10 vs. 0 yrs Experience | 0.26980*** (0.06410) | 0.28258*** (0.06612) | 0.44185*** (0.11720) | 0.43198*** (0.10835) | 0.98466 (0.67211) |
| 30 vs. 0 yrs Experience | 0.38123*** (0.07137) | 0.38662*** (0.07217) | 1.07636*** (0.34288) | 1.04057*** (0.34161) | 1.90279 (2.05104) |
| PANEL B: western Germany – reduced specification | | | | | |
| 10 vs. 0 yrs Tenure | 0.20502*** (0.04288) | 0.13326*** (0.02230) | -0.07074 (0.11390) | -0.08626 (0.11062) | -0.09280 (0.11858) |
| 10 vs. 0 yrs Experience | 0.30175*** (0.05701) | 0.31547*** (0.05737) | 0.52923*** (0.12194) | 0.52172*** (0.13306) | 1.63767*** (0.36872) |
| 30 vs. 0 yrs Experience | 0.39744*** (0.05825) | 0.40371*** (0.05881) | 1.13758*** (0.28854) | 1.10428*** (0.27647) | 3.87058*** (1.01572) |
| PANEL C: eastern Germany – full specification | | | | | |
| 10 vs. 0 yrs Tenure | 0.12500** (0.05746) | 0.13189*** (0.03824) | 0.15378 (0.11216) | 0.15007 (0.10992) | 0.18626 (0.16616) |
| 10 vs. 0 yrs Experience | 0.48880*** (0.10102) | 0.48707*** (0.10039) | 0.19274 (0.13063) | 0.23784* (0.12269) | 2.60483** (1.14005) |
| 30 vs. 0 yrs Experience | 0.51741*** (0.11257) | 0.51579*** (0.11123) | 0.20265 (0.21442) | 0.25994 (0.19702) | 7.62180** (3.44623) |
| PANEL D: eastern Germany – reduced specification | | | | | |
| 10 vs. 0 yrs Tenure | 0.15805*** (0.04853) | 0.15511*** (0.03364) | 0.12275 (0.13537) | 0.11276 (0.13521) | 0.14473 (0.43680) |
| 10 vs. 0 yrs Experience | 0.39939*** (0.10055) | 0.40010*** (0.10589) | 0.17920 (0.15850) | 0.26075* (0.15401) | 2.55752 (1.00453) |
| 30 vs. 0 yrs Experience | 0.37813*** (0.10695) | 0.37877*** (0.11172) | 0.20109 (0.23256) | 0.28442 (0.22420) | 7.53893*** (2.95801) |

Note: Bootstrapped standard errors are presented in parentheses. ***, ** and * indicate statistical significance at the 1, 5, and 10 percent levels respectively. The estimations underlying the predictions in Panels A and C are based on the specifications of Tables 3 and 4, those underlying the predictions in Panels B and D are based on the specifications of Table 5. It is worth noting that public sector employment similar to private sector employment is spread across various industries such that industry dummies continue to be considered. The entries present the predicted change in log real hourly wages when the value of the explanatory variables is changed as indicated. The estimations for western Germany use 2,175 person-year observations for 602 different workers, those for eastern Germany use 831 person-year observations for 217 different workers.

Source: German Socio-Economic Panel (2002–2006).

If the difference in the returns to experience in eastern and western Germany goes back to the depreciation of the work experience accumulated in the former socialist system, then the returns to tenure and experience should not differ for those workers in

eastern and western Germany who started their working life after unification. The predicted effects for the two subsamples are presented in Table 6. The results immediately show that even for young workers the wage structures differ across the two

regions even when taking into account state fixed effects. Irrespective of the estimator or model specification, returns to ten years of experience (except for the very last column) are always higher in western than in eastern Germany. This suggests that there are robust differences in the wage structures of the private sector in eastern and western Germany, which have not been pointed out previously and which demand future research.

Next, we consider the wage structure in the public sectors. Based on the evidence in Figure 3, we expect similar slopes for the public and the private sectors in western Germany, and flatter wage-experience patterns in the private than the public sector in eastern Germany. Table 7 presents the predicted tenure and experience effects for the public sectors in eastern and western Germany. The predictions based on the OLS results in columns 1 and 2 suggest that the return to the first year of tenure is substantially different in the two regions.¹¹ The coefficient of the *OLDJOB* indicator is large and highly significant only for the western German sample, which is reflected in the predicted effects for the first ten years of tenure in columns 1 and 2.

When we compare the wage structure of the western German public sector with that found for the western German private sector (cf. Tables 3 and 5 for the private sector results) we find the same insignificant returns to tenure (in columns 3–5) whereas the returns to experience appear to be larger than in the private sector and equally significant. Given that general labor market experience for individuals working in the public sector is likely to be somewhat “industry-specific” i.e. public-sector-specific experience, the higher return to experience observed in the public compared to the private sector might be interpreted as including returns to industry-specific human capital (for a discussion see Parent 2000 and Dustmann and Meghir 2005).¹²

Interestingly, this pattern does not hold for eastern German public sector workers. They differ from their private sector colleagues already in that their returns to tenure do not disappear when tenure is instrumented in columns 3–5. Certainly the estimates are not statistically significant; however, the

magnitudes of the predicted tenure effects are among the largest we find in all our analyses. Compared to both the OLS results in columns 1 and 2 as well as to the western German public sector workers the high returns to tenure in columns 3–4 come at the price of reduced returns to experience just as for the private sector workers in eastern Germany. Also, reflecting private-sector wage structures, the returns to experience again do not increase substantially when 30 vs. ten years of experience are considered. In conclusion, after controlling for its endogeneity there are considerable (insignificant) returns to tenure in the public sector in eastern Germany. Their positive effect on total wages however may well be mitigated by the relatively low returns to experience which characterize the overall eastern German wage structure. Any rationale explaining the high returns to western German public vs. private sector experience does not appear to hold for the case of eastern Germany.

5 Conclusions

This study evaluates the relevance of seniority pay as a possible determinant of the low level of labor market activity among older German workers. We apply the classic estimation approach of Altonji and Shakotko (1987) to the most recent available data on the German wage structure, taken from the German Socio-Economic Panel (2002–2006). This estimator provides the causal effects of tenure and experience on the lifetime-wage structure if the underlying assumptions regarding the correlation patterns between unobservables and covariates hold true and if the data are not fraught with substantial measurement error. As we cannot control for the potential correlation between experience and match-specific unobservables, our results on the returns to experience provide upper bounds and correspondingly the returns to seniority a lower bounds of the true causal effects.

Overall our results do not support the hypothesis that excessive returns to tenure inhibit the employment of older workers in Germany. On the contrary, we find almost no case of significant effects of tenure on wages, once we use the instrumental variables estimator suggested by Altonji and Shakotko (1987), which is frequently applied in this literature. This result is robust across various specifications of our estimation model and reappears in all subsamples, for the private and the public sector and for the eastern and western German wage structures. In contrast to the minute returns to tenure, we find substantial returns to general labor market experience in

¹¹ The specification in column 1 contains an indicator for “tenure > 1”, our *OLDJOB* variable, whereas the specification in column 2 does not.

¹² Riphahn (2004) finds strong behavioral consequences of high employment protection legislation in the German public sector, which constitutes an incentive to stay in the public sector.

our estimations, particularly for western German workers. For the western German private sector we predict wage increases of about 35 percent for the first ten years of full-time labor force participation, the predictions for the western German public sector even reach 55 percent over the first ten years.

Our second main finding is that the eastern German wage structure both in the private and in the public sector has an extremely flat profile with very small returns to experience. The finding of flat eastern German wage profiles is robust to changes in the model specification, to alternative estimators, and to the choice of private or public sector samples. Even for workers born since 1970 the wage profiles differ substantially between eastern and western Germany. We plan to investigate this issue further in future work, by extending the sample to the female labor force, by explicitly modeling returns to industry-specific experience, and by applying the estimation approach proposed by Topel (1991). Current results do not point to the returns to tenure in the German wage structure as the main culprit behind low employment rates among older workers. In fact, we find surprisingly low wage increases over the life-cycle in eastern Germany which is most strongly affected by unemployment and nonemployment problems.

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Appendix

Table A1
Description of explanatory variables for the full sample

| Variable | Germany | Eastern Germany | Western Germany | Private sector | Public sector |
|------------------------|---------------------|--------------------|--------------------|--------------------|--------------------|
| Born in Germany | 0.8698 (0.0028) | 0.9819 (0.0023) | 0.8356 (0.0035) | 0.8500 (0.0034) | 0.9478 (0.0040) |
| Public sector | 0.2122 (0.0034) | 0.2515 (0.0075) | 0.2003 (0.0038) | – | – |
| Marital status | | | | | |
| Married | 0.7292 (0.0037) | 0.6745 (0.0080) | 0.7459 (0.0041) | 0.7291 (0.0042) | 0.7374 (0.0080) |
| Single | 0.1725 (0.0031) | 0.2060 (0.0069) | 0.1623 (0.0035) | 0.1730 (0.0036) | 0.1638 (0.0067) |
| Widowed | 0.0053 (0.0006) | 0.0096 (0.0017) | 0.0039 (0.0006) | 0.0065 (0.0008) | 0.0010 (0.0006) |
| Divorced | 0.0693 (0.0021) | 0.0853 (0.0048) | 0.0645 (0.0023) | 0.0696 (0.0024) | 0.0689 (0.0046) |
| Separated | 0.0237 (0.0013) | 0.0245 (0.0026) | 0.0233 (0.0014) | 0.0218 (0.0014) | 0.0289 (0.0030) |
| Firm size | | | | | |
| (1; 5] | 0.0391 (0.0016) | 0.0544 (0.0039) | 0.0345 (0.0017) | 0.0472 (0.0020) | 0.0093 (0.0017) |
| (5; 20] | 0.1326 (0.0028) | 0.1837 (0.0067) | 0.1171 (0.0030) | 0.1580 (0.0034) | 0.0384 (0.0035) |
| (20; 100] | 0.2133 (0.0034) | 0.2647 (0.0076) | 0.1977 (0.0038) | 0.2265 (0.0039) | 0.1668 (0.0068) |
| (100; 200] | 0.1052 (0.0026) | 0.1214 (0.0057) | 0.1002 (0.0029) | 0.1035 (0.0029) | 0.1086 (0.0057) |
| (200; 2,000] | 0.2582 (0.0036) | 0.1810 (0.0067) | 0.2815 (0.0043) | 0.2402 (0.0040) | 0.3237 (0.0085) |
| (2,000+) | 0.2516 (0.0036) | 0.1947 (0.0069) | 0.2688 (0.0042) | 0.2246 (0.0039) | 0.3532 (0.0087) |
| State | | | | | |
| Schleswig-Holstein | 0.0294 (0.0014) | – | 0.0384 (0.0018) | 0.0241 (0.0014) | 0.0502 (0.0040) |
| Hamburg | 0.0118 (0.0009) | – | 0.0154 (0.0012) | 0.0122 (0.0010) | 0.0105 (0.0018) |
| Lower Saxony | 0.0800 (0.0022) | – | 0.1044 (0.0029) | 0.0775 (0.0025) | 0.0886 (0.0051) |
| Bremen | 0.0069 (0.0007) | – | 0.0090 (0.0009) | 0.0068 (0.0008) | 0.0079 (0.0016) |
| N-Rhine-Westphalia | 0.2122 (0.0033) | – | 0.2771 (0.0042) | 0.2129 (0.0038) | 0.2133 (0.0074) |
| Hesse | 0.0705 (0.0021) | – | 0.0921 (0.0027) | 0.0729 (0.0024) | 0.0650 (0.0045) |
| Rhineland-P., Saarland | 0.0654 (0.0020) | – | 0.0853 (0.0026) | 0.0672 (0.0024) | 0.0607 (0.0043) |
| Baden-Wuerttemberg | 0.1419 (0.0029) | – | 0.1853 (0.0037) | 0.1543 (0.0034) | 0.0916 (0.0052) |
| Bavaria | 0.1478 (0.0029) | – | 0.1929 (0.0037) | 0.1499 (0.0034) | 0.1352 (0.0062) |
| Berlin | 0.0334 (0.0015) | 0.1426 (0.0060) | – | 0.0271 (0.0015) | 0.0558 (0.0042) |
| Mecklenburg-West. P. | 0.0196 (0.0011) | 0.0836 (0.0047) | – | 0.0182 (0.0013) | 0.0230 (0.0027) |
| Brandenburg | 0.0353 (0.0015) | 0.1508 (0.0061) | – | 0.0312 (0.0016) | 0.0519 (0.0040) |
| Saxony-Anhalt | 0.03706 (0.0016) | 0.1584 (0.0062) | – | 0.0386 (0.0018) | 0.0299 (0.0031) |
| Thuringia | 0.0418 (0.0017) | 0.1786 (0.0065) | – | 0.0418 (0.0019) | 0.0423 (0.0036) |
| Saxony | 0.0669 (0.0021) | 0.2861 (0.0077) | – | 0.0652 (0.0023) | 0.0742 (0.0047) |

Table A1 (continued)

| Variable | Germany | Eastern Germany | Western Germany | Private sector | Public sector |
|--------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
| Industry | | | | | |
| Not applicable | 0.0146 (0.0010) | 0.0261 (0.0029) | 0.0115 (0.0010) | 0.0147 (0.0011) | 0.0147 (0.0022) |
| Agriculture | 0.0368 (0.0016) | 0.0346 (0.0033) | 0.0374 (0.0018) | 0.0457 (0.0020) | 0.0030 (0.0010) |
| Energy | 0.2260 (0.0035) | 0.1666 (0.0068) | 0.2421 (0.0041) | 0.2842 (0.0043) | 0.0077 (0.0016) |
| Mining | 0.1149 (0.0027) | 0.0851 (0.0051) | 0.1229 (0.0031) | 0.1447 (0.0033) | 0.0040 (0.0012) |
| Manufacturing | 0.1047 (0.0026) | 0.1514 (0.0065) | 0.0920 (0.0027) | 0.1206 (0.0031) | 0.0460 (0.0038) |
| Construction | 0.0958 (0.0025) | 0.1089 (0.0057) | 0.0922 (0.0027) | 0.1198 (0.0031) | 0.0083 (0.0017) |
| Trade | 0.1057 (0.0026) | 0.0838 (0.0050) | 0.1117 (0.0030) | 0.0984 (0.0028) | 0.1348 (0.0062) |
| Transport | 0.1678 (0.0031) | 0.1881 (0.0071) | 0.1623 (0.0035) | 0.0973 (0.0028) | 0.4273 (0.0090) |
| Banking, insurance | 0.0799 (0.0023) | 0.0937 (0.0053) | 0.0762 (0.0025) | 0.0253 (0.0015) | 0.2835 (0.0082) |
| Services | 0.0517 (0.0019) | 0.0597 (0.0043) | 0.0496 (0.0021) | 0.0466 (0.0020) | 0.0707 (0.0047) |
| Other | 0.0021 (0.0004) | 0.0020 (0.0008) | 0.0022 (0.0004) | 0.0026 (0.0005) | – |
| No. of obs. | 14,625 | 3,422 | 11,203 | 11,310 | 3,047 |