

## Individual Heterogeneity, Job Matching, and Returns to Tenure in Germany

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### Summary

*Data from the German Socio-Economic Panel are used to examine the roles of individual heterogeneity and job match quality in generating commonly observed wage-tenure profiles. The evidence presented in the paper indicates that once those factors are reflected in the estimations, the returns to seniority are no longer measurable. Job match quality appears to be the dominant factor in the German labor market in generating an upward sloping wage-tenure profile.*

### 1. Introduction

The extent to which increasing wage-tenure profiles reflect increases in productivity associated with the duration of employment, underlying individual ability, and other factors such as job quality, is important in our understanding of the functioning of the labor market. This is particularly true in a dynamic context, where the compensation received in a new job depends on the degree to which the factors that determine pay are transportable from one position to another. In modern economies, where the structural adjustment of employment is common, the transportability of skills from one position to another by workers is relevant not only to the individual or aggregate experiences of workers but also to the efficient utilization of labor resources by society.

This topic has been extensively investigated among labor economists. In the context of the United States, one of the early questions examined was whether the increasing cross-sectional wage-tenure profile was due to payments based on increasing marginal productivity as workers gained skills in specific jobs, or whether better workers got jobs characterized by longer durations. Altonji and Shakotko (1987) showed that, controlling for differing duration of employment, returns associated with tenure are greatly reduced. This suggests a sizeable share of what had previously been attributed to tenure might actually be associated with more able workers having better jobs characterized by longer duration.

This view has subsequently been supported by other researchers. Kletzer (1989) and Ruhm (1990) examined the experiences of workers, who lost their jobs and the degree to which returns to tenure from their old job were transportable to their new one, as well as the role of job matching. Both found that characteristics associated with specific jobs are important determinants of wages but

that, in cross-section regressions, individual heterogeneity, in the form of an individual's ability to maintain returns to prior tenure on new jobs, accounts for a larger share of the returns to tenure. Kletzer (1989) also reported that individual heterogeneity more strongly predicts earnings among white-collar than among blue-collar workers. White-collar workers preserve their earnings better as they move from one job to another than do blue-collar workers. This finding suggests that structural adjustments in white-collar occupations are likely to be less damaging to the overall economy than those involving blue-collar employees because much of the earnings of white-collar workers are based on transportable attributes.

This paper examines the topic in the context of Germany.<sup>1</sup> Important institutional differences in the labor markets of the United States and Germany are expected to affect the analysis. Several factors may assist German workers in maintaining their earnings (and returns to previous tenure) as they move from one job to another. For example, the rate of unionization in Germany is approximately four times that in the United States and may affect tenure premiums both generally and in situations where workers are changing employment. This might lead to stronger transportability of tenure premiums than are observed in the United States

The involvement of workers in corporate management through codetermination and the more structured system of governing worker displacement found in Germany relative to the United States may also assist workers in preserving tenure premiums when they change jobs. Similarly, the more formal training and occupational certification of German workers may allow them to carry earnings premiums between jobs more successfully than United States workers.

On the other hand, a German worker may be less able to maintain returns to his prior job tenure when he loses his job because workers are dismissed in Germany only after a lengthy and formal process. If this costly dismissal process causes employers to be more selective and more likely to require formal certification when they hire a worker, then those workers who lose their jobs may be marked as undesirable. Thus, they may subsequently face reduced employment prospects and earnings.

In order to examine patterns of worker turnover and the relationship of job tenure to earnings in Germany, the study makes use of data from the German Socio-Economic Panel (GSOEP). The panel nature of the data allows an examination of the returns to tenure received by workers prior to losses of employment and on subse-

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<sup>1</sup> This paper only considers workers in the former West Germany.

quent jobs. Both women and men are included in the analysis.

The paper proceeds by outlining the estimation strategy of the paper. Then, the data selected for the estimations are described. The estimates are then presented, and finally some discussion is made of the estimates and what conclusions might reasonably be drawn from them.

## 2. Estimation Strategy

A cross-sectional earnings regression takes the form

$$W_{j,t} = \beta s_{j,t} + \varepsilon_{j,t} \quad (1.)$$

The subscripts  $j$  and  $t$  refer respectively to the job and time period. The variable  $w$  represents log earnings and  $s$  refers to seniority.  $\varepsilon_{j,t}$  is the regression error. Following Ruhm (1990), the error term can be decomposed into an individual effect related to wages independent of time, which is transferable across employers ( $f$ ), another component related to the quality of the job match ( $m_j$ ), and a stochastic disturbance ( $u_{j,t}$ ).

The estimated coefficient of  $\beta$  from equation (1.) will only be unbiased if seniority is uncorrelated with both the individual and job match components of the error term. If individual attributes or job characteristics are positively correlated with seniority, then least squares estimates of  $\beta$  will be biased upward (see Ruhm 1990 or Kletzer 1989).

There are two components of the error term that one would like to control in order to reduce the bias involved in estimating the return to seniority. Considering the individual component first, using the subscript  $r$  to refer to pre-separation periods and  $p$  to refer to post-separation periods, and suppressing the time subscript, post-separation wages can be written as

$$W_p = \beta s_p + f + m_p + u_p$$

The individual component,  $f$ , is correlated with job duration. One instrument commonly used to control for the individual fixed effect is seniority on the prior job, resulting in the following estimation equation

$$W_p = \beta s_p + C s_r + m_p + u_p \quad (2.)$$

Similarly, the job-match component is also correlated with earnings. Rather than instrumenting for job match characteristics, an instrumental variable is constructed for tenure in the post-separation job which is correlated with tenure but not with match or individual characteristics. Following Altonji and Shakotko (1987), an instrument ( $s_p^*$ ) is constructed to measure the deviation in current job tenure and average job tenure. Making this substitution, equation (2.) becomes

$$W_p = \beta s_p^* + C s_r + u_p \quad (3.)$$

Because the instrument measures changes in seniority in a given job, match and individual characteristics are held constant by definition. The estimate of  $\beta$  will then represent an unbiased estimate of the return to tenure.  $C$  will represent an unbiased estimate of the returns to transferable individual characteristics associated with prior tenure.

## 3. Data

The data used in the estimations are drawn from information collected for the German Socio-Economic Panel (GSOEP) in the years 1988 to 1996. Individuals aged 25 to 55 are retained in the sample. A key issue in the analysis is to identify individuals who have changed jobs. In each survey year, individuals are asked if they have changed jobs, and a variety of responses is allowed. Here, job changes that appear most associated with involuntary job losses are identified.<sup>2</sup> This definition is used to reduce the degree of self-selection of the sample. Once those individuals have been identified, a series of dummy variables is created for the sample to allow one to identify the year of job loss as well as preceding and subsequent years. Consistent with these criteria, 387 individuals report a job loss.

The dependent variables used in the analysis are annual earnings and average annual hourly earnings. The annual earnings variable is constructed by the survey staff and is drawn from the GSOEP match file. The average hourly earnings variable is constructed as annual earnings divided by annual hours of work.

The independent variables used in the analysis are age, age-squared, tenure, tenure-squared, education, and education-squared. Tenure is broken down for the analysis into five groups: less than one year, one year, two years, three years, and four or more years. All of the other variables are defined in the usual manner. In some of the estimations, an instrument for years of tenure following a job loss is constructed. That variable is the standard deviation for a particular observation from the mean of tenure for a given job.

## 4. Estimates

Tables 1 and 2 contain parameter estimates of equations (1.) and (2.). The difference in the two tables is that the parameters shown in Table 1 are obtained using the natural log of annual earnings as the dependent variable while those in Table 2 were obtained using the natural log of hourly wages as the dependent variable. Since the qualitative implications of the results in the two tables are

<sup>2</sup> The categories coded as job losses are changes due to company closing, being laid off, being transferred, closure of a person's own business, and the end of contract work.

Table 1

## Variable Means and Annual Earnings Regressions

	Sample Means		W <sub>0</sub>		W <sub>t</sub>	
	All Workers (1)	Layoffs (2)	All Workers (3)	Layoffs (4)	OLS (5)	IV (6)
AGE	29.3	35.8	.02 (.01)*	-.02 (.02)	-.04 (.04)	.0003 (.02)
AGESQ	1621.6	1350.01	-.0002 (.00007)*	.0002 (.002)	.02 (.02)	-.00002 (.002)
EDUC	11.68	11.74	.03 (.01)*	-.10 (.03)*	-.05 (.03)	-.06 (.04)
EDUCSQ	144.8	146.38	.002 (.0004)*	.006 (.001)*	.002 (.001)*	.005 (.001)*
TEN2	.066	.096	.25 (.03)*	.15 (.06)*	-.05 (.04)	-.05 (.05)
TEN3	.063	.085	.22 (.03)*	.18 (.06)*	-.45 (.08)*	-.45 (.09)*
TEN4	.494	.427	.34 (.02)*	.15 (.04)*	-.66 (.05)*	-.47 (.05)*
TEN5	.267	.093	.56 (.02)*	.41 (.06)*	-.26 (.13)	-.12 (.12)
LAY2	.017		-.11 (.05)*			
LAY3	.014		-.07 (.06)*			
LAY4	.073		-.20 (.03)*			
LAY5	.016		-.23 (.05)*			
DUR					.07 (.01)*	-.02 (.02)
DURSQ					-.002 (.0004)*	.009 (.03)
N			11,830	1,640	1,756	1,756
R <sup>2</sup>			.16	.11	.20	.20

Note: Variable Definitions: W<sub>0</sub> = log of annual earnings in current year (full sample) or year prior to displacement.; W<sub>t</sub> = log of annual earnings in period t where the layoff occurred in period one; AGE = calendar age; AGESQ = AGE \* AGE; EDUC = years of education; EDUCSQ = EDUC \* EDUC; DUR = actual or instrumental variable for seniority on post-displacement job; DURSQ = DUR \* DUR; Preseparation Tenure: TEN1 = < 1 year; TEN2 = 1 year; TEN3 = 2 years; TEN4 = 3 years; TEN5 = > 4 years; LAYX = Layoff \* TENX where LAYOFF equals one if a permanent layoff occurs in period 1.

Source: GSOEP 1988–1996. Standard errors are in parentheses. \* indicates rejection of the zero-null at the .05 level. Also included in the regressions are dummy variables for the survey year. The estimates are weighted using longitudinal population weights.

Table 2

## Variable Means and Average Hourly Wage Regressions

	All Workers (1)	Sample Means Layoffs (2)	All Workers (3)	W <sub>0</sub> Layoffs (4)	OLS (5)	W <sub>t</sub> Layoffs (6)	IV (6)
AGE	39.3	35.77	.03 (.004)*	.02 (.02)	.02 (.02)	.02 (.02)	.02 (.02)
AGESQ	1621.6	1350.01	-.0005 (.00005)*	-.01 (.01)	-.002 (.002)	-.002 (.002)	-.0002 (.0002)
EDUC	144.8	11.74	.02 (.01)*	-.05 (.02)*	-.06 (.02)*	-.06 (.03)*	-.06 (.03)*
EDUCSQ	.066	146.38	.001 (.0003)*	.01 (.001)*	.004 (.0009)*	.004 (.001)*	.004 (.001)*
TEN2	.063	.096	.08 (.02)*	-.03 (.04)	-.02 (.03)	-.04 (.03)	-.04 (.03)
TEN3	.49	.085	.08 (.02)*	.07 (.04)	-.21 (.06)*	-.19 (.06)*	-.19 (.06)*
TEN4	.27	.427	.15 (.02)*	.09 (.03)*	-.28 (.04)*	-.18 (.04)*	-.18 (.04)*
TEN5	.016	.093	.27 (.02)*	.26 (.04)*	-.13 (.09)	-.13 (.09)	.03 (.08)
LAY2	.014		-.09 (.04)*				
LAY3	.016		-.01 (.04)				
LAY4			-.06 (.02)*				
LAY5			-.04 (.04)				
DUR					.03 (.007)*		.008 (.012)
DURSQ					-.0006 (.0002)*		.002 (.002)
N			11,830	1,640	1,756	1,756	1,756
R <sup>2</sup>			.18	.15	.17	.17	.19

Note: Variable Definitions: W<sub>0</sub> = log of Average hourly earnings in current year (full sample) or year prior to displacement.; W<sub>t</sub> = log of average hourly earnings in period t where the layoff occurred in period one; AGE = calendar age; AGESQ = AGE \* AGE; EDUC = years of education; EDUCSQ = EDUC \* EDUC; DUR = actual or instrumental variable for seniority on post-displacement job; DURSQ = DUR \* DUR; Preseparation Tenure: TEN1 = < 1 year; TEN2 = 1 year; TEN3 = 2 years; TEN4 = 3 years; TEN5 = > 4 years; TENX = Layoff \* TENX where LAYOFF equals one if a permanent layoff occurs in period 1.

Source: GSOEP 1988–1996. Standard errors are in parentheses. \* indicates rejection of the zero-null at the .05 level. Also included in the regressions are dummy variables for the survey year. The estimates are weighted using longitudinal population weights.

the same and the order of magnitude of the parameter estimates themselves are similar, the discussion here will focus on the estimates contained in Table 1.<sup>3</sup>

The first and second columns of Table 1 show the means of the variables used in the estimations for both all workers and those who experience a job loss. As can be seen from a comparison of the means, those who lose a job tend to be somewhat younger and have less seniority. Their education is similar to that of the group of all workers.

The third column contains estimates based on the years of data prior to the time of job loss for a worker. The variables TEN2 through TEN5 capture returns to seniority for those workers who will not lose a job. The omitted category is workers with less than one year of tenure. As can be seen in the table, the general pattern is for higher returns to higher seniority. The estimated parameters are all significantly different than zero at the .05 level.

The variables LAY2 through LAY5 in the third column represent the returns to seniority for workers in a particular tenure group who subsequently lose a job relative to workers with the same amount of seniority who do not lose a job. As can be seen in the table, the sign on each of these parameters is negative, indicating that workers who will subsequently lose a job are already experiencing reduced earnings prior to the job loss. It also appears that the wage gap widens with tenure as a percentage of earnings.

The estimates in column (4) represent a wage-tenure profile for workers who will later experience job loss. Data for workers who subsequently experience a job loss are used to estimate equation (1.). By comparison to the equivalent parameters in column (3), it can be seen that workers who will lose their jobs have a flatter wage-tenure profile than workers who do not lose their jobs.

Column (5) contains estimates of equation (2.) using data for workers from years after they have lost their jobs. The estimates indicate that workers who lose their jobs experience negative returns to their prior tenure. The negative estimates are significantly different from zero for three of the four tenure groups examined. In the model, these parameters estimates represent returns to individual characteristics associated with prior tenure. The estimates suggest that individuals in Germany who involuntarily change employment are seen as having negative characteristics associated with tenure in their previous position. Offsetting those negative returns to prior tenure are positive returns to current seniority of around 7 percent per year.

The estimates of the returns to current tenure contained in column (5) control for individual characteristics which might be transferable across employers, but they do not control for job match characteristics. The estimates contained in column (6) control for job match by using an instrumental variable instead of actual tenure in the estimations.<sup>4</sup> The interpretation of the parameter estimate for

the variable DUR in column (6) is that it reflects the return to seniority controlling for both individual characteristics and those associated with the job match. As can be seen in column (6), using the instrumental variable, the return to seniority is not significantly different than zero. By comparison to column (5), one can infer that the returns to seniority observed following a job loss are largely associated with characteristics of the job.

## 5. Conclusion

This initial analysis into the returns to seniority in Germany suggests that the majority of the return to seniority observed in cross-sectional earnings regression is associated with job match characteristics. Following the job losses observed in the sample, prior tenure was negatively correlated with earnings, but returns to years of current seniority were 7 percent. When job match characteristics were controlled for in the instrumental variable estimations, the return to tenure was not measurably different from zero. Thus, the positive returns associated with tenure appear to be associated with job match characteristics.

This result differs from the United States, where the majority of the returns to seniority have been found to be associated with individual characteristics. There are many possible reasons for this difference in qualitative conclusions. For example, the sample used here includes both men and women. Also, the composition of blue- and white-collar workers in this German sample may differ considerably from those used for the United States. Investigating the source of this difference in findings will be the subject of future research.

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<sup>3</sup> All estimates shown in the paper employ the longitudinal sample weights.

<sup>4</sup> The construction of the instrumental variable is described in the data section of the paper.

## References

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