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Labor Quality Growth in Germany

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### Abstract

Extending the common baseline model in various dimensions does not fundamentally change the low contribution of labor quality to productivity growth in Germany. Labor quality growth is low owing to a small increase in the share of workers with higher education, a negative contribution from a higher share of females and declines in relative returns. The contribution of actual labor market experience is lower than suggested by an age proxy.

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## 1. Introduction

Previous studies suggest that improvements in human capital, as measured by labor quality growth, have been lower in Germany than in other European countries and in the United States (see Card and Freeman, 2004, Jorgenson, 2005 and Schwerdt and Turunen, 2007). Using representative microdata from the German Socio-Economic Panel (GSOEP) we improve on previous estimates by using an actual labor market experience measure (instead of an age proxy) and by carefully considering the impact of German unification on determinants of labor quality. We also provide a methodological contribution: empirical approaches relating to what variables should be used and how weights should be determined are typically driven by data limitations. We evaluate the robustness of our estimates along several of these dimensions.

## 2. Alternative estimates

We take the BLS (1993) approach as our baseline. First, we estimate cross-sectional wage equations using weighted OLS:

$$\log W_i = \alpha + X_i \beta + Z_i \eta + \varepsilon_i \quad (1)$$

The dependent variable is the individual hourly wage. In the baseline model,  $X$  includes dummies for two education (with secondary education as the omitted category) and five age categories (with those between 34 and 45 as the omitted category).<sup>3</sup> Equation 1 is estimated separately for males and females and gender is therefore included as a third characteristic. The right hand side includes part-time employment status and sector as control variables in  $Z$ .

We consider three alternatives to this baseline. First, we include a full set of interactions among the human capital variables. Fitzenberger and Kohn (2006) find systematic differences across cohorts in the evolution of skill wage premia in Germany.<sup>4</sup> These effects are captured by the interaction between age and education in the flexible model. The interacted model is equivalent to using mean wages for each group (after controlling for characteristics included in  $Z$ ), similar to the approach in Ho and Jorgenson (1999).

Second, we replace age with a measure of actual labor market experience. Age is commonly used as a proxy for labor market experience when information on actual experience is not available.

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<sup>3</sup> Education categories include those with lower secondary education (ISCED categories 0-2), upper secondary education (3 and 4) and tertiary education (5-6).

<sup>4</sup> Laquesta et al. (2008) argue that a more flexible model is important for measuring labor quality growth in Spain.

However, using such a proxy may lead to important biases. The GSOEP includes detailed calendar information on main activity that is used to construct a measure of actual experience in full-time employment (in months).<sup>5</sup> Zoghi (2008) constructs actual experience measures for the United States and illustrates their impact on labor quality growth.

Third, we construct measures of labor quality separately for the unified Germany and for former West German regions. Both the composition of hours and relative returns are likely to have been different in East and West Germany. Recent studies also suggest that these differences may persist (see Orłowski and Riphahn, 2008).

Estimates of labor quality growth are computed by weighting total hours worked with weights constructed from the predicted wages from equation (1). Specifically, we construct predicted wages  $\tilde{W}_{j,t}$  for each worker group  $j$  and year  $t$ . Weights are the average of the share of each group in total compensation in adjacent years:

$$\bar{s}_{j,t} = \frac{1}{2}(s_{j,t} + s_{j,t-1}) \quad (2)$$

where

$$s_{j,t} = \frac{\tilde{W}_{j,t} H_{j,t}}{\sum_j \tilde{W}_{j,t} H_{j,t}} \quad (3)$$

and  $H$  is total hours worked. Change in aggregate labor input is:

$$\ln(L_t / L_{t-1}) = \sum_j \bar{s}_{j,t} \ln(H_{j,t} / H_{j,t-1}) \quad (4).$$

Finally, growth in labor quality is equal to the difference between growth in aggregate labor input and growth in raw hours:

$$\Delta \ln Q = \Delta \ln L - \Delta \ln H \quad (5).$$

We use GSOEP data from 1984-2007. Our full sample includes 200,482 person-year observations with positive hours data. Information on individuals from East Germany are included since 1990. Cross-sectional population weights have been used to aggregate hours worked and to perform weighted OLS regressions.

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<sup>5</sup> This measure has been previously used to estimate returns to experience in Germany (see for example, Orłowski and Riphahn, 2008). The sample with information on actual experience is somewhat smaller than the total sample. We have recomputed all estimates using the smaller sample to confirm that differences in the results are not driven by different samples.

### 3. Results

All four estimates indicate a continuous increase in labor quality in the last 20 years (see Figure 1). The average growth rate for the baseline model, 0.32 percent year-on-year, is very close to the estimate based on data from the European Labor Force Survey (LFS) (0.27 percent) in Schwerdt and Turunen (2007). Our GSOEP based estimate is well below the estimate in Jorgenson (2005) (0.52 percent), but above the estimate in Card and Freeman (2004) (0.21 percent).

Differences in the average growth rates across the alternative measures are below 0.1 percentage point. This supports the view that the simple baseline model is sufficient to describe the overall contribution of labor quality to labor productivity growth. This result also confirms those from a similar exercise for the United States: Zoghi (2008) finds that the “simplest specification ... yields results on labor composition ... that are quite similar to the more elaborate specifications”. The estimates also show a common pattern over time. The late 1980s were characterized by low growth, followed by a period of strong growth immediately after unification. Labor quality growth has moderated thereafter.<sup>6</sup>

While the empirical choices reflected in the alternative estimates are not crucial for overall labor quality growth, they do matter for understanding its underlying determinants. Changes in the composition of total hours worked in Germany are characterized by three broad trends. First, while the shares of total hours worked by education categories were relatively stable until the early 1990s, thereafter the share with low (high) education has been declining (increasing). Second, population ageing has a strong impact on the composition. Following the increasing share of prime-aged workers, the share of workers with 10-20 year of actual labor market experience increased strongly in the mid 1990s. The share of those with less than 5 years of actual experience has been declining, coinciding with the declining share of young workers. Third, the share of women in total hours worked has increased substantially.

Changes in the weights reflect changes in relative returns. Previous studies suggest that the wage distribution across skill groups has been relatively stable over the sample period (for a review, see Fitzenberger and Kohn, 2006). However, since the East German wage distribution was more compressed than in the West, trends in weights reflect the mixing of the two distributions, as well as a gradual adjustment process thereafter. Table 1 presents ratios of imputed wages from equation (1).

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<sup>6</sup> Alternative measures also show differences. In particular, after the immediate unification period, the index for West Germany shows the highest growth rates, whereas the experience based measure shows the lowest growth rates.

Focusing on the first and last year, relative returns to education indeed appear relatively stable. However, immediately following unification, returns to higher education declined. Relative returns increase again in the 2000s, but do not fully reverse the loss. Returns to age have increased and more so for the oldest workers. In some contrast, with the exception of those with more than 30 years of experience, returns to experience have declined. Finally, the unification appears also to have contributed to a permanent decline in the gender gap. Overall the quantitative impact of trends in relative returns on labor quality growth is small. Keeping wages fixed at their early 1980s level suggests labor quality growth at 0.35 percent for the model based on experience (as opposed to 0.28 percent with actual wages).

Table 2 presents a full set of results for the experience based model. The rise in educational attainment is the main driver of the increase in labor quality, while increase in experience also contributes positively. However, the first order contribution of actual labor market experience is approximately half the contribution of age in the baseline index. The contribution of gender is negative, dampening labor quality growth on average by almost 0.1 percentage point over the sample period. While it is standard to include gender as a determinant, these results suggest -- assuming that only a part of the wage differential between men and women reflects productivity -- that the index including women may understate actual improvements.

#### **4. Conclusion**

Our results show that going beyond a common baseline model does not fundamentally change the measured contribution of labor quality to productivity growth. However, including an actual experience measure and exploring differences across West and East Germany helps in understanding determinants of labor quality growth. We find that low labor quality growth is mainly driven by a relatively low increase in the share of hours worked by workers with higher education and a significant negative contribution from a higher share of hours worked by females. Results also suggest a lower direct contribution from actual experience than suggested by an age proxy. Increasing the share of educated workers and ensuring proper incentives for accumulating labor market experience are needed to boost productivity growth in Germany.

## References:

BLS (1993) "Labor Composition and US Productivity Growth, 1948–1990", *Bureau of Labor Statistics Bulletin 2426*, Washington DC.

Card, D. and Freeman, R. (2004): "What Have Two Decades of British Economic Reform Delivered?", in Card, D., Blundell, R. and Freeman, R. (editors): *Seeking a Premier Economy: The Economic Effects of British Economic Reforms, 1980-2000*, NBER.

Fitzenberger, B. and Kohn, K. (2006): "Skill Wage Premia, Employment, and Cohort Effects: Are Workers in Germany All of the Same Type?", *IZA Discussion Papers 2185*

Ho, M. and Jorgenson, D. (1999): "The Quality of the U.S. Work Force, 1948-95" , unpublished manuscript, Harvard.

Jorgenson, D. (2005): "Accounting for Growth in the Information Age", in Aghion, P. and Durlauf, S. (editors), *Handbook of Economic Growth*, Amsterdam, North-Holland.

Lacuesta, A., Puente, S and Cuadrado, P. (2008): "Omitted Variables in the Measurement of a Labor Quality Index: The Case of Spain", *Bank of Spain working paper*.

Orlowski, R. and Riphahn. R. (2008): "The East German Wage Structure after Transition", *IZA Discussion Papers 3861*.

Schwerdt, Guido and Jarkko Turunen (2007): "Growth In Euro Area Labor Quality," *Review of Income and Wealth*, vol. 53(4), pages 716-734.

Zoghi, C. (2008): "Measuring Labor Composition: A Comparison of Alternate Methodologies", forthcoming in Abraham, K., Spletzer, J. and Harper, M. (editors): *Labor in the New Economy*, NBER, University of Chigago Press.

Figure 1: Alternative estimates

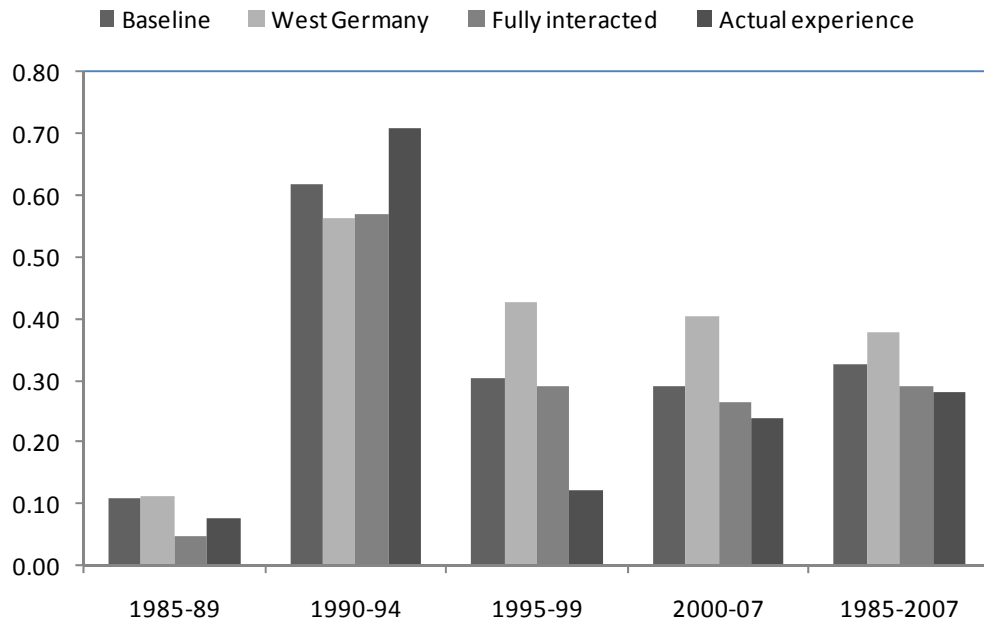




Table 1: Relative imputed wages

	Whole sample					West Germany				
	1985	1990	1995	2000	2007	1985	1990	1995	2000	2007
Male	1.40	1.43	1.29	1.29	1.29	1.40	1.39	1.33	1.35	1.32
Age 25-34	1.88	1.65	1.73	1.94	1.93	1.88	1.81	1.72	1.94	1.84
Age 35-44	2.18	1.86	1.99	2.22	2.40	2.18	2.08	2.05	2.28	2.30
Age 45-54	2.09	1.89	2.03	2.25	2.53	2.09	2.16	2.07	2.32	2.46
Age 55-64	2.05	1.66	2.01	2.32	2.52	2.05	1.96	2.01	2.40	2.40
Age 65+	1.06	1.36	1.82	2.09	2.06	1.06	1.67	1.86	2.10	1.92
Experience 1-5 <sup>1</sup>	1.72	1.83	1.78	1.81	1.73	1.72	1.87	1.72	1.75	1.60
Experience 5-10 <sup>1</sup>	1.99	1.97	2.03	2.03	2.00	1.99	2.09	1.98	1.96	1.83
Experience 10-20 <sup>1</sup>	2.35	2.17	2.21	2.23	2.23	2.35	2.42	2.24	2.23	2.09
Experience 20-30 <sup>1</sup>	2.47	2.25	2.43	2.31	2.44	2.47	2.55	2.45	2.32	2.32
Experience 30+ <sup>1</sup>	2.20	2.06	2.26	2.30	2.44	2.20	2.36	2.29	2.32	2.31
Education Middle	1.40	1.15	1.25	1.32	1.30	1.40	1.36	1.29	1.33	1.24
Education High	1.90	1.46	1.64	1.80	1.81	1.90	1.90	1.76	1.86	1.74

*Note:* Ratios of imputed wages over baseline categories. Baseline categories are Female, Age 15-24, Experience 0-1, and Education low. The results from experience categories have been calculated from the experience model, the rest are from the baseline model.

Table 2: Contributions to labor quality

	Total	Sex	First order		Second order			Third order
			Experience	Education	SexExp	ExpEdu	SexEdu	SexExpEdu
1983	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
1985	101.19	99.77	100.47	100.85	100.28	99.86	100.00	99.96
1986	101.28	99.56	100.42	101.05	100.56	99.77	100.03	99.90
1987	100.70	99.53	100.16	100.59	100.54	99.94	100.05	99.89
1988	100.66	99.38	99.86	100.89	100.67	99.95	100.06	99.85
1989	100.38	99.19	99.81	100.79	100.76	99.93	100.06	99.84
1990	101.44	98.68	100.95	102.01	100.39	99.57	99.92	99.93
1991	102.26	98.92	101.52	101.98	100.39	99.63	99.90	99.94
1992	103.10	98.83	102.14	102.62	100.37	99.34	99.88	99.94
1993	103.14	98.73	102.17	102.76	100.44	99.26	99.85	99.94
1994	103.99	98.81	102.54	103.46	100.38	99.01	99.80	100.00
1995	104.34	98.82	102.56	103.97	100.36	98.87	99.78	100.01
1996	104.40	98.78	102.66	104.20	100.29	98.70	99.76	100.04
1997	104.47	98.80	102.36	104.33	100.36	98.85	99.79	100.00
1998	104.81	98.71	102.81	104.45	100.33	98.73	99.73	100.06
1999	104.61	98.62	102.64	104.43	100.37	98.77	99.78	100.04
2000	105.30	98.58	102.14	105.86	100.41	98.56	99.75	100.05
2001	105.20	98.40	102.33	105.68	100.49	98.57	99.75	100.03
2002	105.69	98.40	102.50	106.01	100.51	98.56	99.75	100.01
2003	106.19	98.26	103.00	106.27	100.47	98.46	99.77	100.01
2004	106.20	98.08	103.23	106.11	100.54	98.51	99.80	99.99
2005	105.99	97.92	103.03	106.14	100.69	98.49	99.81	99.98
2006	106.92	97.95	103.57	106.87	100.60	98.19	99.80	100.01
2007	106.62	97.94	103.16	106.91	100.64	98.24	99.78	100.02
Average	0.28	-0.09	0.14	0.29	0.03	-0.08	-0.01	0.00

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