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Premiums and Penalties for Over- and Undereducation Cross-Time and Cross-National Comparisons in the United States and Germany

By Mary C. Daly, Felix Büchel, and
Greg J. Duncan*

Summary

Previous research has shown that the labor market rewards workers who complete more schooling than their job requires and penalizes workers who complete less schooling than their job requires. In this paper, we investigate how the structural changes in the United States labor market during the 1970s and 1980s have affected the rewards and penalties associated with over- and undereducation, and whether the same rewards and penalties for mismatched education observed in the United States extend to Germany. Consistent with a universalistic view of labor markets, we find that there are more similarities across countries than over time.

1. Introduction

An intriguing finding in the literature on the role of education in the labor market concerns workers who have acquired either more or less education than they say their jobs require. Contrary to predictions from a rigid, structural view of jobs (Thurow 1975), several authors have discovered that the labor market rewards workers for having completed more schooling than their jobs require and penalizes workers who have "too little" schooling (Duncan and Hoffman, 1981; Sicherman, 1991; Cohn and Kahn, 1995).

In this paper, we extend this literature in two ways. First, we investigate how the structural changes in the labor market in the United States over the 1970s and 1980s as documented in Levy and Murnane (1992) have affected the rewards and penalties associated with having too much or too little schooling for a job. Second, we investigate whether the same rewards and penalties for overeducation present in the United States extend to Germany, a country with a much more structured educational system and labor market. We test explicitly for differences over time in the United States and at a point in time between the United States and Germany. A universalistic view of labor markets would predict more similarity across countries than across time. This is precisely what we find.

2. Background

In 1976, the Panel Study of Income Dynamics became the first national survey to ask workers explicitly about both years of completed schooling and the amount of schooling required by the jobs they held. An analysis of these data by Duncan and Hoffman (1981) revealed considerable amounts of, as well as positive wage payoffs for, overeduca-

tion. Regardless of race and sex, between 40 percent and 50 percent of workers reported having more schooling than their jobs required. Roughly one in ten workers reported having less schooling than required.

Although some predicted that this excess education could not be absorbed by the labor market (Berg 1970; Thurow 1975) and, thus, would result in a large, semipermanent pool of overeducated and underutilized workers, Duncan and Hoffman found that surplus years of schooling (i.e., the positive difference between actual and required education) had real economic value to workers. Their research showed a positive and significant rate of return to more-than-required years of schooling, although lower than the returns to years of required schooling. In addition, they found that years of deficit education (i.e., the negative difference between actual and required schooling) appeared to extract a wage penalty, although the relevant coefficients were significant only for male workers.

Cohn and Khan (1995) replicated this analysis using data from the 1985 waves of the PSID and found similar results — wage premiums for surplus education and wage penalties for deficit education. However, they did not test for structural differences between 1985 and 1976. Sicherman (1991) extended the work on overeducation with an analysis of the human capital and subsequent mobility of overeducated workers. He found that workers with surplus schooling tended to have less work experience or other components of human capital than workers with adequate or deficit education for their jobs. This suggests that workers and employers may trade off among different forms of human capital. In terms of subsequent mobility, Sicherman found that overeducated workers experienced greater job and occupational mobility than other workers and that observed mismatches between actual and required schooling are frequently transitory steps along a career path.

Despite growing enrollments in universities, declines in the financial health of publicly financed educational systems, and increases in the unemployment rates of well-educated workers, the phenomenon of "overeducation" has received very little attention in Germany. The most complete empirical study on this topic revealed a dramatic increase in the prevalence of overeducation among young academics, women, and East Germans (Buechel and Weissshuhn 1996). Other studies by Buechel (1994), Plicht, Schober, and Schreyer (1994), Buechel (1995), Buechel and Matiaske (1996), and Buechel (1996) have focussed on the prevalence of over-education among particular groups, for instance East Germans and academics, but have not estimated returns to overeducation. These studies suggest that although the percentage of German workers with more education than their jobs require is substantially lower than in the United States — a circumstance one would expect

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given the more structured nature of the German school-to-work institutions — the patterns of surplus and deficit education by gender, job tenure, and work experience are similar.

Importance of Cross-Time and Cross-Country Comparisons

The labor market in the United States has changed substantially over the last two decades. (See Levy and Murnane 1992 for a thorough discussion.) These changes include increases in both the supply of and demand for highly skilled or educated workers, significant increases in the returns to schooling, and the apparent introduction of nonneutral technology that disproportionately benefits more educated individuals. Many analysts consider these changes to be the most important factors underlying growing wage and earnings inequality in the United States. However, to date no one has documented whether the increasing returns to completed schooling carry over to increased premiums for overeducation and increased penalties for undereducation.

Much of the overeducation literature has focussed on the question of whether labor markets can adapt to changes in the educational capital of the employee base as the neo-classical model predicts. If labor markets do adapt, then any mismatch of education and job requirements is a short-run phenomenon and will be eliminated as employers alter technology to take advantage of a more educated work force. Moreover, surplus education will yield a positive return as it increases the productivity of workers in any technology. If, however, production technologies are inflexible and cannot exploit the benefits of more educated workers, then surplus education will yield zero returns. At issue is whether the ability to adapt is related to the level of flexibility in the labor market.

By comparing the returns on overeducation between the United States and Germany we can more directly address this question. In contrast to the United States labor market, the German labor market is heavily influenced by both government and unions. This involvement results in a labor market more regulated and inflexible than the one operating in the United States. Yet, despite these differences, researchers have consistently demonstrated unexpected cross-country similarities in outcomes such as returns to education (Couch 1994), wage growth and mobility (Burkhauser, Holtz-Eakin, and Rhody forthcoming) and wage and income inequality (Burkhauser and Poupore forthcoming).

3. Data

Our information on the extent and economic effects of overeducation in the United States and Germany comes from the Panel Study of Income Dynamics (1976 and 1985 waves) and the German Socio-Economic Panel (1984 wave), respectively. The Panel Study of Income Dynamics (PSID) is an ongoing longitudinal survey that provides infor-

mation on a representative national sample of over 5,000 households. Interviews are usually conducted with the “head” of each family, who is defined as the husband or male partner in male-female relationships and is asked to provide detailed individual level information about himself, his spouse, and all other individuals in the family age 16 and older.

Like the PSID, the German Socio-Economic Panel (GSOEP) is a longitudinal micro-database containing nationally representative socio-economic information on over 6,000 German households and their members. The panel began in 1984 and has been fielded annually over the last 13 years. The data contain an oversample of immigrant worker households but can be weighted to be nationally representative. Although the GSOEP currently contains an East German sample, this did not begin until 1990 and, thus, is not included in our analysis.

Each of these panels collects information on individual earnings and a broad set of individual demographic and socio-economic characteristics. In addition, the 1976 and 1985 surveys of the PSID and the 1984 survey of the GSOEP asked individuals about formal education requirements on their job. In the PSID the question reads, “How much formal education is required to get a job like yours?” Note that the time frame is current, rather than the time at which the person got the job. Respondents select from the following categories: (1) 0-5 grades; (2) 6-8 grades; (3) 9-11 grades; (4) 12 grades; (5) some college, associate degree; (6) college degree, B.A. or B.S.; and (7) advanced or professional degree. The GSOEP question asks “What sort of training is usually necessary for this job?” (1) no special training; (2) short period of on-the-job training; (3) more extensive on-the-job training; (4) special training/course(s); (5) completion of regular vocational training; (6) completed college/university degree. We combine information from these questions with the report of actual completed schooling to generate a set of variables describing the amount of surplus or deficit education for each individual.

Sample

Our sample includes men and women aged 18 to 64 who were employed at the time of the survey and successfully reported the information necessary to calculate their completed education, job-required education, wage rate, and work experience. To ensure cross-national comparability our sample is restricted to non-black men and women in the United States and West German citizens of German nationality¹. In addition to these restrictions, we eliminate

¹ The labor market experiences of black Americans and foreigners in Germany have been found to be significantly different from the experiences of nonblack Americans and Germans. Since the focus of this paper is on cross-national comparisons and not on between-group differences within the United States or Germany, we have chosen to exclude black Americans and foreigners in Germany from the analysis. There was no East German sample in 1984, so they are also excluded from the analysis.

Table 1

**Extent of Over- and Undereducation in the United States (1976, 1985) and
Germany (1984) among Working Men and Women Aged 18 to 64**

	United States				Germany	
	1976		1985		1984	
	Men	Women	Men	Women	Men	Women
Completed Education = Required Education	45.2	52.0	47.0	49.7	78.8	71.9
Completed Education > Required Education	38.5	36.8	31.8	33.5	14.3	20.7
Completed Education < Required Education	16.3	11.3	21.2	16.8	6.9	7.4
Total	100.0	100.0	100.0	100.0	100.0	100.0
Average Years of Completed Education	12.8	12.7	13.4	13.3	11.7	11.5
Average Years of Required Education	11.1	11.0	12.5	12.1	11.6	11.1
Average Years of Surplus Education (for those with surplus education)	5.6	5.4	4.7	4.9	2.2	2.6
Average Years of Deficit Education (for those with deficit education)	3.0	2.5	2.8	2.7	0.7	0.7

Note: All tests for differences in values over time and across countries were significant at the 5 percent level. The United States sample consists of nonblack men and women who were either heads or wives (partners) in a PSID household in the interview year. The German sample consists of West German men and women.
Source: Panel Study of Income Dynamics (1976, 1985) and the German Socio-Economic Panel (1984).

from the sample students, the irregularly part-time employed, and the self-employed². These exclusions provide us with samples of: 3,204 in the United States in 1976, 4,438 in the United States in 1985, and 3,066 in Germany in 1984.

4. Results

The Extent of Over- and Undereducation over Time and across Countries

Before examining the returns to surplus education over time and across countries, we first describe its extent. Table 1 presents the distribution of matched, surplus, and deficit education in the United States (1976 and 1985) and in Germany (1984) by gender. The extent of overeducation in the United States declined for both men and women from 1976 to 1985. In 1976 nearly 40 percent of men and women were overqualified for their jobs. By 1985, this percentage had declined to a little over 30 percent. This decline was statistically significant. In contrast, the percentage of men and women with too little education for their job increased during the same period growing from 16.3 percent to 21.2 percent among men, and from 11.3 percent to 16.8 percent for women. This reduction in the proportion of United States workers with surplus education and increase in the proportion with deficit education occurred despite an increase in the average level of completed schooling.

Education and job mismatches are much less common in Germany. As the two rightmost columns of Table 1 show, German men are about half as likely to be overeducated and about 60 percent less likely to be undereducated than working men in the United States. The same pattern holds for German women. However, in contrast to the United States, in Germany it is women, rather than men, who are

more likely to be over- or undereducated. While years of schooling are not directly comparable across countries, the differences in the average years of surplus and deficit education between men and women in the United States and Germany indicate that even when mismatches do occur in Germany, the magnitude of the mismatch is substantially smaller³.

Components of Human Capital: Education and Experience

Sicherman's (1991) research suggests that employers may trade off between formal education and on-the-job training when hiring new employees. We conduct a similar analysis using total work experience, rather than job tenure. We expect workers with the least work experience should have the highest prevalence of surplus education and workers with the most experience should have the highest prevalence of deficit education. In Table 2 we report the percentage of men and women who are over- or undereducated for their position classified by years of work experience. Work experience is defined as the total number of full-time or regular part-time years an individual has worked since age 18.

² In the United States, the irregularly part-time employed are identified as those who work fewer than 500 hours per year. For Germany, a direct question from the GSOEP is used to identify those who are irregularly part-time employed. Students and the self-employed are excluded based on their own identification of their status.

³ There is no direct comparison between years of education across the United States and Germany. The average years of surplus education are best thought of as degree levels or certifications. For a good summary of the relationship between the United States and German educational systems see Couch (1994).

Table 2

**Extent of Surplus and Deficit Education in the United States (1976, 1985) and Germany (1984)
among Working Men and Women Aged 18 to 64,
By Work Experience Since Age 18**

Work Experience	United States				Germany	
	1976		1985		1984	
	Men	Women	Men	Women	Men	Women
Surplus Education						
1 to 5 years	45.4	43.1	38.6	36.5	18.8	31.0
5 to 10 years	45.7	37.2	34.1	38.5	13.9	17.9
10 to 15 years	39.4	33.6	34.7	34.7	11.9	14.3
15 to 20 years	41.9	43.7	38.9	29.3	13.5	20.7
20 or more years	33.7	31.1	26.9	30.2	14.1	21.3
Correlation Work Experience and Amount of Surplus Education	-0.13*	-0.01	-0.10*	-0.05*	-0.09*	-0.12*
Deficit Education						
1 to 5 years	9.8	7.8	17.0	8.0	5.5	2.4
5 to 10 years	6.6	7.3	15.4	11.0	3.7	5.8
10 to 15 years	13.0	11.6	15.1	14.0	5.0	5.0
15 to 20 years	10.0	8.3	13.2	22.2	4.2	7.7
20 or more years	23.4	19.6	28.5	23.1	9.2	14.2
Correlation Work Experience and Amount of Deficit Education	0.22*	0.17*	0.23*	0.14*	0.12*	0.16*
<p>* Represents significance at the 5 percent level. The United States sample consists of nonblack men and women who were either household heads or wives (partners) in a PSID household in the interview year. The German sample consists of West German men and women.</p> <p>Source: Panel Study of Income Dynamics (1976, 1985) and the German Socio-Economic Panel (1984).</p>						

As Table 2 shows, workers with the least job tenure or work experience are indeed the most likely to have more schooling than is required by their job. Likewise, those with the most experience are also most likely to have too little education. For example, among men with 20 or more years of work experience in 1985, about one-half were overeducated or undereducated for their job: about one-quarter falling into each category. In contrast, among men with between one and five years of work experience in 1985 nearly 40 percent had surplus education, while only 17 percent had too little education for their current positions. The same pattern holds for the United States in 1976 and for Germany in 1984, although the levels are much different. In all cases there is a significant and negative correlation between work experience and surplus education and a significant and positive correlation between work experience and deficit education.

These findings indicate that being over- or undereducated is correlated with having less or more work experience. However, these findings also show that, despite similar patterns for the United States in 1976 and 1985, substantial changes in the levels of surplus and deficit education occurred, so that by 1985 a substantially larger percentage of men with little work experience also had a deficient education for their current job. In addition, as Buechel and Weissshuhn (1996) found, a significantly larger fraction of German women are overeducated than German men.

Economic Value of Surplus and Deficit Education

The previous two sections have compared the prevalence of surplus and deficit education over time in the United States and between the United States and Germany. In this section we examine the economic rewards and penalties for having too much or too little education. To do this we compare the results from estimated earnings functions where an individual's completed schooling is decomposed into the number of years required for his or her current job and the number of years of surplus or deficit education. In this way, we allow required, surplus, and deficit education to have different effects on earnings.

In Table 3 we present the results from two specifications of a conventional cross-sectional earnings regression. In the first specification we include a variable representing the individual's actual educational attainment (i.e., years of completed schooling). In the second specification we decompose completed schooling into required, surplus, and deficit education and enter each as a separate variable in the model. The dependent variable in both models is the natural logarithm of hourly earnings. The other independent variables are years of work experience since age 18, experience squared, and a dummy indicating residence in a city of 500,000 people or more.

Consistent with other work in this area, we find completed education and experience to have positive and

Table 3

**Effects of Education on In Hourly Wage Rate in the United States (1976, 1985) and Germany (1984)
among Working Men and Women Aged 18 to 64**

	United States				Germany	
	1976		1985		1984	
	Men	Women	Men	Women	Men	Women
<i>Regression I</i>						
Completed Education	0.059* (0.004)	0.092* (0.005)	0.065* (0.004)	0.095* (0.005)	0.085* (0.003)	0.079* (0.004)
Years of Work Experience	0.053* (0.004)	0.034* (0.005)	0.056* (0.004)	0.052* (0.004)	0.032* (0.002)	0.038* (0.003)
Work Experience Squared	-0.0008* (0.0001)	-0.0006* (0.0001)	-0.0008* (0.0001)	-0.0009* (0.0001)	-0.0005* (0.0001)	-0.0008* (0.0001)
Reside in City of > 500,000	0.219* (0.023)	0.133* (0.029)	0.173* (0.031)	0.167* (0.034)	0.050* (0.014)	0.080* (0.019)
Adjusted R ²	0.325	0.273	0.257	0.265	0.369	0.32
<i>Regression II</i>						
Required Education	0.061* (0.004)	0.090* (0.005)	0.078* (0.004)	0.109* (0.005)	0.090* (0.003)	0.090* (0.005)
Surplus Education	0.045* (0.005)	0.061* (0.007)	0.054* (0.006)	0.086* (0.007)	0.049* (0.008)	0.066* (0.008)
Deficit Education	-0.034* (0.009)	-0.036* (0.016)	-0.016* (0.008)	-0.025* (0.011)	-0.078* (0.014)	-0.038* (0.022)
Years of Work Experience	0.052* (0.003)	0.032* (0.005)	0.052* (0.004)	0.0450* (0.005)	0.030* (0.002)	0.037* (0.003)
Work Experience Squared	-0.0008* (0.0001)	-0.0006* (0.0001)	-0.0008* (0.0001)	-0.0008* (0.0001)	-0.0005* (0.0001)	-0.0007* (0.0001)
Reside in City of > 500,000	0.214* (0.022)	0.129* (0.028)	0.158* (0.030)	0.160* (0.033)	0.051* (0.013)	0.080* (0.019)
Adjusted R ²	0.339	0.265	0.294	0.306	0.379	0.333
<p>Note: Standard errors are in parentheses. * indicates significance at the 5 percent level. The United States sample consists of nonblack men and women who were either heads or wives (partners) in a PSID household in the interview year. The German sample consists of West German men and women.</p> <p>Source: Panel Study of Income Dynamics (1976, 1985) and the German Socio-Economic Panel (1984).</p>						

significant effects on earnings in all time periods and in both countries. Also consistent with the literature, we find that the rate of return on completed education increased for non-black men in the United States between 1976 and 1985, moving from 5.9 percent to 6.5 percent per additional year of education. There was no notable increase in the return to experience among these men. In contrast, women with mean experience saw no change in the return on education, but saw their return to work experience increase from 3.4 percent in 1976 to 5.2 percent in 1985.

German men and women also enjoy positive and significant returns on education and experience. In contrast to American workers, education is relatively more important than experience. This is particularly true of German men. Among German men with mean characteristics the rate of return to work experience is about 17 percent of the rate of return to education. In contrast, among working men in the United States the rate of return to experience is approximately 40 percent of the rate of return to education.

Having established the general results for completed education, experience, and earnings we now look to the

decomposed version of the education variable. Like others we find that required, surplus, and deficit education each have a significant effect on earnings. Surplus and required education increase hourly earnings, while absolute years of deficit education decrease hourly earnings. Comparing the United States experience across years, we find that the return to both required and surplus education increased between 1976 and 1985, but that the relative rewards of surplus education (the difference in the return to required and surplus schooling) declined. These results also indicate a decline in the wage penalty paid for having too little education. Taken together, these results indicate that the American labor market has increased its rewards to both required and actual education.

Examining the results for the Germans reveals similar patterns. Surplus education earns a positive return for both men and women, although at about one-half for men and two-thirds for women of the rate earned on required education. One important difference between the results for Germany and the United States is the apparent penalty workers pay for having less-than-required schooling. For German

Table 4

**Differences in the Effects of Education on log Hourly Wage Rate in the United States (1976, 1985)
and Germany and the United States (1984, 1985) among Working Men and Women Aged 18 to 64**

Fully Interacted Models: ¹⁾	Pooled Regression Results					
	Men			Women		
	Baseline United States 1985	United States 1976	Germany 1984	Baseline United States 1985	United States 1976	Germany 1984
<i>Regression I</i>						
Completed Education	0.065* (0.004)	−0.006 (0.005)	0.020* (0.008)	0.095* (0.006)	−0.003 (0.008)	−0.016 (0.013)
F-Statistic from Chow Test on Difference in Education Variables ²⁾	Base	1.46	1.58	Base	0.00	0.32
<i>Regression II</i>						
Required Education	0.078* (0.004)	−0.016* (0.006)	0.010 (0.008)	0.109* (0.005)	−0.019* (0.008)	−0.020 (0.015)
Surplus Education	0.054* (0.006)	−0.008 (0.008)	−0.008 (0.020)	0.086* (0.007)	−0.025* (0.011)	−0.022 (0.024)
Deficit Education	−0.016* (0.008)	−0.019 (0.012)	−0.061 (0.035)	−0.025* (0.011)	−0.010 (0.020)	−0.012 (0.066)
F-Statistic from Chow Test on Difference in Education Variables ²⁾		3.04	1.17		0.92	0.28
<p>Note: Standard errors are in parantheses. * indicates significance at the 5 percent level. The United States sample consists of nonblack men and women who were either household heads or wives (partners) in a PSID household in the interview year. The German sample consists of West German men and women. — ¹⁾ Fully interacted models include the following control variables: experience, experience squared, a dummy for residing in a city of 500,000 or greater, and a complete set of interaction terms. — ²⁾ The Chow tests for structural differences across time periods and countries are constructed for the education variables only. All other variables were entered in the regression separately by year or country.</p> <p>Source: Panel Study of Income Dynamics (1976, 1985) and the German Socio-Economic Panel (1984).</p>						

men the wage penalty associated with too little education for the job is nearly five times as high as the penalty extracted from men in the United States. For German women it is one and a half times as large. These different results for deficit education are consistent with the lower rate of return associated with work experience, implying that education, rather than work experience or some combination of the two, is the basic component of human capital in Germany.

Thus far we have speculated about differences over time periods and across countries by examining the results from separate regressions. We now formally test for differences in these samples using two methods: (i) fully interacted models and (ii) Chow tests for differences in parameters across samples. The results of these tests are reported in Table 4.

Column 1 of Table 4 shows the coefficients on the education variables for our baseline regression, the United States in 1985. Columns 2 and 3 report the increase or decrease in the parameter estimate associated with the 1976 American sample and the 1984 German sample, respectively, obtained from the fully interacted models. Results from the Chow tests are reported in the final row of each section.

Overall, Table 4 indicates more similarities among our samples than differences. Across time periods in the United States both men and women experienced significant increases in the returns to required education. Only women saw the premium paid for surplus education increase significantly, and neither men nor women suffered an increase in the penalty paid for deficit education. Results from the Chow test for differences in the education parameters over time suggest that only for males were these changes significant.

Turning to the comparison of the United States and Germany we find no significant differences in the returns to education, either total completed or required, surplus, and deficit considered independently. This is true for both men and women.

5. Summary

Although there were notable and well-documented differences between the labor market in 1976 and the labor market in 1985 in the United States, as well as substantial institutional differences between school to work transitions

in the United States and Germany, we find little evidence that these differences significantly affect the patterns of compensation associated with over- and undereducation. In all cases workers with surplus education received a wage premium and those with deficit education suffered a wage

penalty. These findings support the idea that productivity on any job is affected by the level of education a worker brings to employment. Moreover, consistent with a universalistic view of labor markets, we find more similarities between countries than over time.

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