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## More evidence on the puzzle of interindustry wage differentials: the case of West Germany

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Working Paper No. 400

More Evidence on the Puzzle of  
Interindustry Wage Differentials:  
The Case of West Germany

by

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MORE EVIDENCE ON THE PUZZLE OF  
INTERINDUSTRY WAGE DIFFERENTIALS:  
THE CASE OF WEST GERMANY

Abstract

In West Germany workers with similar skills earn different wages according to the industry in which they are employed. This finding is no surprise given the institutional rigidities of the West German labor market. But the similarity of the interindustry wage structures in West Germany and in the U.S. points to a puzzle since these countries exhibit totally different labor market institutions. Typical high-wage industries in both countries are motor vehicles and petroleum refining. Furthermore, large correlations of wages between any two qualification groups of workers within an industry in both countries cannot easily be explained by standard neoclassical labor market theories. Once alternative theories are accepted, the economic policy prescriptions regarding the labor market become very different.

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MORE EVIDENCE ON THE PUZZLE OF INTERINDUSTRY WAGE DIFFERENTIALS:  
THE CASE OF WEST GERMANY\*

Standard neoclassical labor market models predict that workers with identical skills will receive the same wage independent of the industry in which they are employed. To maximize profit, firms expand employment to the point where the wage rate equals the value of labor's marginal product. With full information and zero transaction costs, factor mobility ensures that the wage rates and simultaneously the marginal products of workers with identical abilities are equalized across industries. Yet, recent empirical evidence from the U.S. labor market casts doubt on the explanatory power of the standard competitive model. Several recent studies [Dickens and Katz, 1987a; 1987b; Katz and Summers, 1989; Krueger and Summers, 1987; 1988]<sup>1</sup> find substantial inter-industry wage differentials for workers with similar individual characteristics doing apparently similar jobs. The interindustry wage structure is reported to be remarkably stable over time, thus ruling out the hypothesis that the observed differentials are caused by transitory phenomena.

We would be less surprised to find the law of one price violated in the highly regulated European labor markets where the mobility of labor is relatively low. But the claim that significant wage differentials for equally skilled workers even persist in the U.S. economy with its supposedly competitive labor market has some far-reaching implications. Since, according to a widespread view, models should be judged by their ability to imitate patterns observed in the real world [Lucas, 1980], the presented evidence - if one believes it to be correct - would suffice to reject the standard competitive labor market model. Consequently, this evidence has been cited [e.g. by Krueger and Summers, 1988] to support alternative models of wage determination such as the

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\* We have benefited from helpful comments by seminar participants at the Kiel Institute of World Economics and by Barbara Kauffmann, Stefan Sinn and Frank D. Weiss.

<sup>1</sup> See Thaler [1989] for a short survey of these and related studies.

efficiency wage theories.<sup>2</sup> These models suggest that firms might find it profitable to pay more than market clearing wages in order to reduce e.g. turnover costs, selection costs, and shirking by workers. As these costs are likely to differ across industries, efficiency wage theories may help to explain interindustry wage differences for workers with similar characteristics. Once the noncompetitive models of wage determination are accepted, the policy prescriptions become very different from the standard neoclassical ones. Advocates of industrial targeting and strategic trade policies are supported in their calls for the promotion of high-wage ("better jobs") industries [Katz and Summers, 1989].

Thus, empirical research on interindustry wage differentials is highly relevant for a wide range of positive and normative issues, especially because Katz and Summers [1989] claim that the pattern of relative wages is remarkably stable not only over time, but also across countries. This paper adds to the debate by presenting empirical evidence on interindustry wage differentials in West Germany which seems to be an interesting candidate for testing the international similarity of the interindustry wage structure. Comparing the results with those for the U.S. economy should yield further insights since the institutional setups of labor markets in the two countries are very different.

### I. Evidence from the U.S.

In the U.S., average wages differ substantially between industries. Krueger and Summers [1987, p. 21] and Katz and Summers [1989, p. 219] report a standard deviation of the estimated wage differentials of 24 percent and 28 percent respectively for 1984. The industries with the highest premiums are petroleum, mining, public utilities, communication, and transport equipment; low-wage industries include eating and drinking, personal services,

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<sup>2</sup> For surveys of efficiency wage models see Yellen [1984], Stiglitz [1986], and Katz [1986].

apparel, and leather. These findings are not surprising because different industries employ highly qualified and less qualified labor in different proportions. Therefore, industries with a relatively large fraction of well trained workers will exhibit high average wages, while those with a relatively large fraction of unskilled workers will have low average wages.

Adjusting for the different skill-mixes should eliminate the observed differences in average wages according to the standard competitive model. Krueger and Summers [1987] and Katz and Summers [1989] control for worker characteristics by using individual survey data from the Current Population Survey (CPS). They estimate wage equations by regressing individual (log) wages on a host of worker characteristics that are expected to explain differences in individual wages, such as education, age, sex, occupation, race, union status, marital status, and region. However, industry dummies included in the regression proved to have significant coefficients. This implies that wages differ between industries even if the differences in workers' abilities are taken into account.

In addition, accounting for skill and demographic differences barely changes the original ranking of industries according to the wages they pay. That is, industries with a high (low) average wage level on average seem to be high-wage (low-wage) industries for all skill groups of employees. However, the differences in worker characteristics explain some of the interindustry wage variation; the standard deviation of the estimated wage differentials between industries with controls decreases to 15 percent [Krueger and Summers, 1987, p. 19; Katz and Summers, 1989, p. 218]. Most of this decline results from controlling for occupation, region, race, and sex. Similar observations have been made by Dickens and Katz [1987a; 1987b]. They conclude [1987b, p.8] that the "large wage differences across industries not accounted for by observed worker characteristics or labor market location appear to be something of a mystery".

The interindustry wage structure is reported to be relatively stable over time. Krueger and Summers [1987, p. 24] find a high correlation of the wage structure in nine major U.S. industries<sup>3</sup> during the 1900-1984 period. For selected years after 1915, they report correlations with the wage structure in 1984 ranging from 0.76 to 0.98. These results seem to rule out an explanation of the observed wage differentials based on transitory sectoral demand shifts or a short-run immobility of labor.

Furthermore, the U.S. interindustry wage structure seems to be correlated positively with the interindustry wage structures of other countries. Katz and Summers [1989, p. 224] compare relative wages in manufacturing in nine countries<sup>4</sup> in 1983. They control for different skill mixes by looking at a single occupational group (operatives) only and report cross-country correlations of relative wages ranging typically between 0.6 and 0.9. The correlation between wage differentials for operatives in West Germany and the U.S. is 0.95, this is the highest correlation between any pair of the nine countries. This international similarity of the industry wage structure suggests that country-specific institutional factors do not possess a high explanatory power. To test this a priori implausible hypothesis properly, we shall try to replicate the reported results for the U.S. with the West German data in more detail.

## II. Interindustry Wage Differentials in West Germany

The statistical sources for our empirical analysis are the "Arbeiterverdienste in der Industrie" and the "Angestelltenverdienste in Industrie und Handel" published by the Statistisches Bun-

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<sup>3</sup> The nine industries are agriculture, manufacturing, mining, construction, transportation, communications, the wholesale and retail trade, FIRE (finance, insurance and real estate), and services.

<sup>4</sup> The nine countries are Australia, Chile, France, West Germany, Japan, Korea, Sweden, the United Kingdom, and the United States.



desamt [a; b]. These statistics contain the effective hourly wages for three qualification groups of blue-collar workers (Arbeiterverdienste) and the effective monthly salaries for four qualification groups of white-collar workers at the two digit industry level as well as employment-weighted average wages and salaries. We concentrate our analysis on those industries for which data for all qualification groups are available for most of the years since 1960 because we want to analyze the widest possible range of qualification differences across industries.

The exact definitions of the seven qualification groups are given by the Statistisches Bundesamt [a; b]. In short, we have three groups of skilled workers (white-collar workers, groups 2, 3, and 4), one group of specialized workers (blue-collar workers, group 1), and three groups of unskilled workers (white-collar workers, group 5 and blue-collar workers, groups 2 and 3). Since all wages and salaries are published for both men and women we get a total of 14 quasi different qualification groups. From the original data for the months January, April, July, and October we calculate average wages and salaries<sup>5</sup> for each qualification group in each industry for selected years. Thus, our analysis is based on aggregate data, in contrast to the studies for the U.S. which are based on individual data. Another difference is that our sample consists of manufacturing plus mining, construction, and public utilities, whereas the U.S. studies analyze the economy-wide spectrum of industries. The high level of aggregation and the exclusion of the more heterogeneous service sector from the analysis should bias our results in favor of the acceptance of the law of one price for workers with identical skills. Therefore, our analysis can be interpreted as a rather strong test of Katz and Summers' [1989] hypothesis that the interindustry wage structure is similar across countries, since we employ a totally different set of data and only investigate an (albeit important) subsector of the West German economy.

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<sup>5</sup> In the remainder of the paper the term earnings refers to wages for blue-collar workers and to salaries for white-collar workers.

To gain an overall impression of the interindustry earnings structure in West Germany, we calculate average earnings differentials for blue-collar and white-collar workers for both men and women (Table 1).<sup>6</sup> Following these estimates, the petroleum refining and motor vehicle industries pay the highest wages for all worker groups, while leather industries, footwear, apparel, and precision ceramics pay the lowest wages for all worker groups. But this high-wage/low-wage pattern does not hold uniformly for all industries. For example, in ship building, only blue-collar workers receive above average earnings, and in precision mechanics only female blue-collar workers earn more than the respective industry average. That is to say, our four worker groups do not display the same degree of interindustry earnings variation.

It is reasonable to expect relatively low interindustry earnings differentials for relatively homogeneous qualification groups and for employees with a comparatively high degree of regional mobility. Alternatively, high interindustry earnings differences are more likely to be found among the more heterogeneous blue-collar workers of different industries where ability differences not captured by our set of data may explain more of the variation than among the white-collar workers. Higher interindustry earnings differentials are also more likely to be found for employees with a relatively low mobility such as women, especially women with children at home. Traditionally, a married couple chooses to live near the working place of the main income earner, and so far as a general rule this has been the man. Therefore, women might only be mobile across industries near their home which in turn is determined by job opportunities for the husband. Another reason for the lower interindustry mobility of married women with children at home can be that in most cases they and not their husbands take care of the children when they become

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<sup>6</sup> Here it is sufficient to limit the analysis to one year (1986) because the West German interindustry wage hierarchies for different qualification groups are reported as having been remarkably stable (correlation coefficients higher than 0.9) since 1970 [Gundlach, 1986].

Table 1 - Interindustry Earnings Differentials for Selected Industries, 1986 (percent) (a)

Industry(b)	Men		Women	
	Blue-collar workers	White-collar workers	Blue-collar workers	White-collar workers
	(1)	(2)	(3)	(4)
Mining	7.5	9.1	-	6.4
Stone and Clay	-6.7	-6.9	5.3	-5.0
Iron and Steel	1.0	-2.5	8.1	-4.0
Nonferrous Metals	-1.0	-0.8	3.8	-0.2
Chemicals	6.8	4.3	8.4	12.6
Petroleum Refining	27.6	25.8	25.2	32.1
Rubber	-1.9	-3.2	6.2	0.9
Lumber	-14.2	-13.3	-3.9	-18.1
Pulp, Paper, Paperboard	1.0	8.1	-0.5	2.4
Structural Engineering	3.2	2.4	4.4	-2.1
Machinery, exc. electrical	1.6	-0.1	7.1	-3.6
Computer Equipment	-1.4	13.5	10.4	17.9
Motor Vehicles and Equipment	10.5	9.0	24.2	8.8
Ship Building	4.0	-7.7	13.3	-11.1
Aircraft	8.2	6.6	12.6	7.3
Electrical Engineering	-3.0	2.9	3.1	3.0
Precision Mechanics, Optics	-4.8	-5.7	3.6	-3.4
Metal Products	-6.8	-6.2	-1.2	-7.6
Precision Ceramics	-15.9	-18.7	-6.5	-13.1
Glass	-4.0	-9.2	-6.5	-9.5
Furniture	-7.1	-12.0	-0.6	-15.9
Musical Instruments, Toys, Jewelry	-11.4	-11.7	-7.3	-11.6
Paper and Paperboard Products	-10.3	-7.9	-11.0	-10.5
Printing	9.4	-2.4	10.1	-2.3
Plastics Products	-9.1	-6.2	-7.4	-8.2
Leather	-17.6	-11.3	-9.9	-12.2
Leather Products	-21.2	-20.1	-18.6	-20.7
Footwear	-19.4	-18.1	-10.0	-20.7
Textiles	-15.1	-13.6	-6.3	-10.2
Apparel	-16.0	-15.4	-11.6	-10.2
Food, Beverages, Tobacco	-8.1	-9.2	-11.1	-4.8
Construction	-3.8	-0.2	-	-7.9
Public Utilities	11.0	-4.3	14.3	3.0
Employment weighted				
Standard deviation	0.304	0.219	0.450	0.375
note:				
Correlation coefficient with				
U.S. wage differentials				
in 1984(c)	0.886	0.872	0.808	0.830
in 1939(d)	0.815	-	-	-

(a) Percentage deviation of employment weighted average wages (salaries) from the industry average total. - (b) Classification according to the West German Wage and Salary Statistics. - (c) Correlation coefficients with labor quality adjusted U.S. wage differentials; 21 observations for columns (1), (2) and (4), 19 observations for column (3). - (d) 14 observations.

Source: Krueger and Summers [1988]; Slichter [1950]; Statistisches Bundesamt [a; b]; own calculations.

sick. Therefore, a relatively short distance between the place of work and the home might be a further restriction which can explain interindustry wage differentials between men and women. Higher wages in more distant industries, then, are a smaller incentive to change the job for women than for men.

In general, our findings are consistent with these considerations. The employment-weighted standard deviation of the interindustry earnings differences is higher for blue-collar workers than for white-collar workers and it is higher for women than for men. That is to say, interindustry earnings differentials are smallest (the standard deviation is 0.219) for the most homogenous and most mobile employee group, namely male white-collar workers, and they are highest (the standard deviation is 0.450) for the most heterogenous and most immobile employee group, namely female blue-collar workers.

We find a rather strong positive correlation between each of our (subgroup) earnings structures (columns (1) through (4)) and the labor quality adjusted U.S. wage structure in 1984 as reported by Krueger and Summers [1988] in spite of our estimated group-specific differences. Even the U.S. interindustry wage structure of 1939<sup>7</sup> is correlated positively with the West German interindustry wage structure of 1986 (correlation coefficient of 0.82). This finding seems to confirm the hypothesis that wage structures are similar across countries independent of the time period under consideration. Given the results for the U.S. this would imply that a high (low)-wage industry is also a high (low)-wage industry for all qualification groups in that industry in West Germany and that this pattern is stable over time. Taken at face value, however, the high correlation coefficient between the U.S. and the West German interindustry wage structure as measured by our first rather broad concept is not sufficient to reject the hypothesis of equal wages for equally qualified workers across industries, especially since our results for West Germany seem to indicate smaller interindustry wage differentials than in the

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<sup>7</sup> Data are taken from Slichter [1950].

U.S. [Krueger and Summers, 1988, p. 265]. But in contrast to the methodology used in the recent U.S. studies, we cannot simultaneously test for the magnitude and the statistical significance of interindustry wage differentials. Therefore, we try to test for the existence of high-wage and low-wage industries in West Germany with a different approach in more detail.

Here we use an F-test to decide whether the wage and salary structure of a given industry differs from the average wage and salary structure of our sample. The test criterion is given by [Maddala, 1977]

$$F = \frac{(RRSS - URSS) / (k + 1)}{URSS / (n_1 + n_2 - 2k - 2)}$$

with RRSS = restricted sum of squared residuals  
URSS = unrestricted sum of squared residuals  
k + 1 = number of parameters  
n<sub>1</sub>, n<sub>2</sub> = number of observations in different samples.

We run regressions of the form

$$\ln w = C + \sum_{i=1}^6 Q_i + G + u$$

with u = error term

to estimate the squared sum of residuals from an analysis of variance. Our observations are the effective monthly wages and the effective monthly salaries (ln w) of the previously-mentioned 14 qualification groups, namely three blue-collar worker and four white-collar worker groups, for men and women respectively. Q and G are dummy variables for the different qualification groups (Q) and for women (G). The regression constant C captures the impact of the (omitted) seventh qualification group. The procedure to calculate the F-value for each industry involves three regressions of the form described. The first regression which combines the 14 industry specific wages and salaries and the 14 average

industry wages and salaries in one sample with 28 observations generates the restricted residual sum of squares (RRSS). The unrestricted residual sum of squares (URSS) is estimated from the two samples which add up to the first regression sample: the residual sum of squares following from a regression on the 14 average industry wages and salaries is added to the residual sum of squares following from a regression on the industry-specific wages and salaries.

The critical F-value for 8 parameters and 12 degrees of freedom, which follows from our sample of 28 observations and 7 (exogenous) dummy variables is 2.85 for the 5 percent statistical significance level. That is, a computed F-value higher than 2.85 indicates the inequality of the coefficients in our two regression sets. With such a result we reject the null hypothesis of indifferent wages and salaries for equal qualifications between the industry under consideration and the computed industry average. With an estimated F-value lower than the critical F-value we accept the "indifferent wage structure" hypothesis. The detailed results of the F-test for different years are presented in Table 2. The general picture emerges that for West German industries there is a statistically significant interindustry earnings dispersion for employees classified within the same qualification group. Recession years such as 1982 and 1975 seem to have no major impact on this result, thus ruling out explanations based on cyclical behavior. From the year 1960 to 1986 the interindustry wage dispersion apparently grew in terms of the number of industries whose wages and salaries significantly deviate from the industry average: from 15 industries out of a sample of 31, to 26 industries out of a sample of 33.<sup>8</sup> Even for the last years this is less than what has been observed for the U.S., where wages in nearly all the industries are reported to deviate significantly from the industry average. However, this small dif-

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<sup>8</sup> An increase in the interindustry wage differentials especially in manufacturing industries has also been reported for the U.S. since 1970 [Bell and Freeman, 1985].

Table 2 - F-Test Results on Interindustry Wage Differentials

Industry <sup>1</sup>	1986		1982		1980		1975		1970		1960	
	F	q	F	q	F	q	F	q	F	q	F	q
Mining	25.47*	17.11+	28.75*	11.51	30.83*	10.83	17.15*	11.35	2.01	33.65+	17.66*	8.90
Stone and Clay	1.01	2.92	1.32	9.72	1.22	5.08	.70	10.06	.81	24.70+	1.38	10.67
Iron and Steel	12.46*	1.11	5.61*	9.28	4.14*	11.27+	2.74	14.39+	3.67*	10.31	3.80*	4.99
Nonferrous Metals	12.28*	18.94+	1.31	12.31+	4.91*	17.88+	1.88	16.08+	1.64	22.09+	1.07	12.58+
Chemicals	21.82*	2.45	13.36*	3.04	14.30*	3.84	9.81*	3.05	13.39*	7.23	3.82*	20.88+
Petroleum	54.79*	4.31	60.07*	.49	57.13*	1.07	44.98*	1.26	42.35*	1.41	10.47*	8.49
Rubber	.83	10.09	1.23	12.71+	2.11	10.03	2.21	15.89+	5.02*	7.77	7.84*	5.14
Lumber	7.05*	4.74	4.75*	1.80	4.66*	11.03	5.43*	4.64	4.20*	11.39	14.33*	8.09
Pulp, Paper, Paperboard	7.64*	9.37	4.45*	6.87	3.89*	3.42	1.76	18.62+	4.17*	14.41+	2.08	8.76
Structural Engineering	2.33	2.41	.55	7.33	1.46	15.39+	2.67	9.19	2.40	8.39	.64	2.87
Machinery, exc. electrical	3.60*	23.66+	1.24	12.24+	1.48	13.26+	1.17	10.22	.76	17.43+	2.17	14.49+
Computer Equipment	6.18*	7.76	2.74	10.58	2.55	7.82	1.57	8.24	n.a.	n.a.	n.a.	n.a.
Motor Vehicles and Equipment	55.12*	8.01	20.00*	4.58	31.01*	7.26	24.29*	6.70	7.88*	7.18	6.38*	14.71+
Ship Building	1.79	9.53	.82	9.20	.75	6.16	2.18	7.17	.65	9.49	1.41	6.13
Aircraft	4.76*	6.01	5.34*	3.28	4.91*	1.91	3.22*	4.86	3.13*	13.55+	n.a.	n.a.
Electrical Engineering	3.93*	11.39	.76	18.71+	1.00	10.62	.96	1.94	1.97	6.72	.85	4.43
Precision Mechanics, Optics	.91	21.79+	.58	11.92	.51	13.25+	2.62	9.27	1.34	8.95	1.72	3.69
Metal Products	1.04	4.40	1.63	7.33	1.07	7.10	1.38	6.37	1.68	.99	.15	9.54
Precision Ceramics	15.22*	7.32	4.51*	13.56+	1.73	9.66	2.71	11.61	3.28*	7.37	1.01	11.79
Glass	1.97	15.27+	1.99	17.12+	2.06	14.22+	1.77	5.76	.74	29.90+	.72	8.71
Furniture	3.44*	10.80	3.24*	10.17	2.24	16.67+	3.42*	6.76	3.23*	6.54	26.47*	6.66
Musical Instruments, Toys, Jewelry	9.93*	13.67+	5.26*	4.61	5.95*	3.13	1.84	3.37	11.87*	9.91	10.68*	7.17
Paper and Paperboard Products	10.93*	10.20	7.89*	10.37	15.22*	13.88+	9.28*	10.63	3.35*	15.37+	2.17	13.16+
Printing	6.32*	17.79+	3.49*	8.84	3.67*	9.01	3.20*	14.25+	4.71*	11.22	2.47	3.17
Plastics Products	5.58*	14.18+	5.91*	16.23+	4.65*	20.76+	4.09*	5.28	1.90	14.88+	1.66	5.08
Leather	11.53*	5.58	3.89*	3.75	7.07*	9.25	3.59*	3.07	2.14	8.74	7.10*	7.85
Leather Products	36.63*	1.19	40.26*	2.05	7.80*	2.14	16.57*	1.96	10.26*	6.20	4.43*	8.53
Footwear	10.58*	1.69	7.10*	3.45	11.48*	4.19	9.64*	3.65	7.00*	15.95+	3.85*	53.27+
Textiles	7.52*	7.63	15.74*	7.00	15.99*	5.97	3.66*	3.02	2.67	13.24+	2.23	16.90+
Apparel	17.65*	3.69	19.94*	5.27	18.59*	4.77	18.61*	3.78	17.88*	3.62	6.09*	2.95
Food, Beverages, Tobacco	8.91*	17.51+	3.94*	14.21+	7.02*	15.55+	5.24*	15.32+	4.20*	37.71+	2.20	43.98+
Construction	29.52*	31.17+	5.30*	25.19+	5.04*	16.48+	2.83	32.88+	1.25	9.20	20.77*	27.42+
Public Utilities	7.99*	4.78	6.93*	4.74	6.86*	4.00	19.06*	3.40	11.13*	9.38	3.20*	5.13
Number of industries deviating from the industry average	26		22		22		18		19		16	

F = estimated F-value

q = Breusch-Pagan test results for heteroscedasticity

\* = statistically significant deviation from the interindustry average wages and salaries at the 5 percent level

+ = rejection of homoscedasticity at the 5 percent level

<sup>1</sup> Classification according to the German Wage and Salary Statistic.

Source: Statistisches Bundesamt [a; b]; own calculations.

ference in the findings for West Germany and the U.S. may partly have a technical reason.

One basic assumption of the F-test is equal error variances in the different subsamples. In this case the probability of rejecting a true hypothesis is minimized. But in the case of heteroscedasticity the true level of significance always becomes larger than the nominal level presupposed under homoscedasticity [Toyoda, 1974]. Although Toyoda's quantitative results have been shown to be generally too pessimistic about the effect of heteroscedasticity on the F-test, his qualitative result about the true level of significance, especially in the case of equal subsample sizes, is worth considering [Schmidt, Sickles, 1977]. With respect to our results this implies that with heteroscedasticity the critical F-value for the 5 percent level will be somewhat lower than indicated by the F-table. Therefore, judged by the F-test an increase in the number of industries whose wage and salary structure statistically differs from the industry average is the likely outcome if heteroscedasticity is present.

Our results for the Breusch-Pagan test<sup>9</sup> for heteroscedasticity (see "q" in Table 2) confirm this expectation. For each year there are some industries where the estimated F-value may be small only because of unequal error terms in the two regression subsets<sup>10</sup> implying that the hypothesis of no interindustry wage differences has to be rejected more frequently than indicated at the presented 5 percent level. This finding brings us closer to the reported U.S. result in terms of the number of industries whose wages deviate significantly from the average industry wage.

Taken together, our results suggest that on average a high (low)-wage industry is a high (low)-wage industry for all qualification groups of employees. That is, the correlation of average industry wages and qualification specific wages should be rather strong.

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<sup>9</sup> Breusch, Pagan [1979]; see Judge et al. [1982] and Johnston [1984] for a textbook version.

<sup>10</sup> Precision mechanics and glass are examples for the year 1986.



As reported for the U.S. the correlation coefficient is 0.95 between the interindustry wage differentials estimated with and without labor quality control variables [Krueger, Summers, 1987, p. 19; Katz, Summers, 1989, p. 218].

We try a similar, though weaker test with the West German data. In a cross-section analysis we correlate the average blue-collar worker wages with the blue-collar worker wages for the different qualification groups, and we use the same procedure for the white-collar worker salaries (Table 3). In contrast to the wide range of control variables used by Krueger and Summers [1987; 1988] and by Katz and Summers [1989] which a priori allow a low or no correlation to be expected it is more likely to find some correlation in our data, because we correlate an average wage (salary) with one of its components. Therefore, we should at least find a similarly high correlation coefficient, if the underlying hypothesis of substantial interindustry wage differentials even after controlling for a number of variables (where qualification and sex may be the most important) is also true for West Germany. Our results cast some doubt on this consideration. Firstly, the correlations are lower than expected. Secondly, the correlation coefficients for high qualification groups are higher than the correlation coefficients for low qualification groups. This pattern emerges for both men and women and for white-collar workers as well as for blue-collar worker (see the columns and rows entitled "average").

Furthermore, directly correlating the wages and salaries of the different qualification groups with each other reveals that our second hypothesis, namely that wage and salary levels between industries differ across all qualification groups, may be somewhat overstated. All qualification groups are significantly correlated with each other in a statistical sense, but the degree of correlation substantially declines the more different the qualification groups become (Table 3).<sup>11</sup> This means that there is no

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<sup>11</sup> In contrast to this finding Dickens and Katz [1987b, p. 9] report "... large correlations between average wages in any two occupations within an industry" for private sector non-union workers in the U.S.

Table 3 - Correlation Coefficients between Selected Wages and Salaries, 1986 (a)

	Blue-collar worker wages			White-collar worker salaries					
	aver- age(b)	group 1	group 2	group 3	aver- age(b)	group 2	group 3	group 4	group 5
<b>Blue-collar worker wages</b>									
average(b)	1.00	0.94	0.91	0.75	x	x	x	x	x
group 1	0.91	1.00	0.88	0.70	x	0.84	0.82	0.65	0.64
group 2	0.94	0.88	1.00	0.86	x	0.72	0.75	0.51	0.56
group 3	0.89	0.78	0.90	1.00	x	0.45	0.58	0.28	0.35
<b>White-collar worker salaries</b>									
average(b)	x	x	x	x	1.00	0.97	0.90	0.85	0.71
group 2	x	0.78	0.74	0.62	0.88	1.00	0.89	0.74	0.55
group 3	x	0.80	0.78	0.71	0.94	0.94	1.00	0.83	0.61
group 4	x	0.71	0.72	0.73	0.92	0.85	0.92	1.00	0.75
group 5	x	0.58	0.60	0.61	0.85	0.67	0.72	0.88	1.00

(a) Upper triangle: men  
lower triangle: women.

(b) Unweighted average.

Source: Statistisches Bundesamt [a; b]; own calculations.

uniform pattern in the interindustry wages and salaries of our set of data. Not every high (low)-wage industry seems to pay high (low) wages for all qualification groups. It is tempting to conclude from these results that interindustry qualification and sex differences of the employees explain more of the interindustry wage variation in West Germany than in the United States. Following neoclassical labor market theory one would have expected just the opposite result given Germany's labor market institutions and the high degree of labor market regulations on the one hand and given the high mobility and the low degree of unionization in the U.S. labor market on the other.<sup>12</sup> However, this interpretation is subject to a strong caveat.

<sup>12</sup> For an account of the inflexibilities of the West German labor market see Soltwedel, Trapp [1988].

So far, we have neglected an important aspect in our discussion of the interindustry wage structure, namely the employment shares of the different qualification groups. Table 4 offers two insights. Firstly, the structure of the skill pattern of industrial employment did not change between 1973 and 1986; the correlation coefficient of these skill patterns is 0.98. Secondly, the employees of four qualification groups account for more than 70 percent and male workers account for some 80 percent of total industrial employment.

Table 4 - Percentage Shares of Different Qualification Groups in Total Industrial Employment (a), 1973 and 1986

	1973	1986
Blue-collar workers	75.8	70.7
men group 1	31.4	33.9
men group 2	20.2	18.2
men group 3	7.7	5.3
women group 1	1.0	0.8
women group 2	7.7	5.8
women group 3	7.9	6.7
White-collar workers	24.2	29.3
men group 2	6.0	9.7
men group 3	8.8	10.1
men group 4	2.1	1.8
men group 5	0.2	0.1
women group 2	0.4	0.7
women group 3	2.7	3.4
women group 4	3.4	3.3
women group 5	0.6	0.4
note: women total	23.7	21.1

(a) Mining, manufacturing, construction, and public utilities.

Source: Statistisches Bundesamt [a; b]; own calculations.

Especially the second point is important for the interpretation of our results because industrial employment is apparently concentrated on skilled and specialized male workers. In other words, industry specific wages and salaries for unskilled workers and for women in general may partly reflect regional wage and

salary variation due to their small employment share. That is, the probability for a specific wage or salary in a given industry to reflect regional labor market conditions increases as the employment share of this specific wage or salary group declines. If we accept this hypothesis the implications with respect to our findings are twofold.

Firstly, our finding of a relatively small correlation coefficient between the wages (salaries) of more distant qualification groups indicates the presence of the regional variation effect. For male workers, for example, the lowest correlation coefficients are found for the white-collar groups 4 and 5 (see Table 3), and these groups show the lowest employment share for male workers (see Table 4). Therefore, one can speculate that the correlation coefficients between more distant wage and salary groups would be higher in the absence of the regional variation effect in the data. Secondly, the number of industries whose wages and salaries deviate significantly from the industry average for all qualification groups (see Table 2) would presumably increase if the test procedure were able to control for regional variation effects.

To sum up, if the existence of the supposed regional variation effects is accepted our results for West Germany are in line with two basic hypotheses: high (low)-wage industries are high (low)-wage industries for all qualification groups, and the West German and the U.S. interindustry wage structures are remarkably similar.

### III. Qualifications and Outlook

One can attempt to rationalize this interindustry wage pattern in the framework of the standard competitive model in two ways.<sup>13</sup> Firstly, the interindustry differences in wages for workers with similar characteristics may be necessary to compensate for dif-

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<sup>13</sup> Thaler [1989, p. 183] calls them "alibis".

ferences in working conditions. In this case the international similarity of interindustry wage structures would be no surprise. But if the observed wage premia were merely compensating payments for harder working conditions, then we would expect quit rates in the high-wage industries to be about as high as in the low-wage industries. However, the empirical evidence for the U.S. suggests that quit rates and labor quality adjusted industry wage differentials are negatively correlated [Katz and Summers, 1989]; that is, workers in high-wage industries are less inclined to quit than workers in low-wage industries. Therefore, industry wage premiums seem to reflect rents to "good" jobs and are not merely compensating payments. Furthermore, while it may be reasonable to expect large differences in working conditions for some occupational groups across industries, it is unlikely that these large differences exist for all other employee groups (e.g. secretaries or janitors) as well. But our correlation results (Table 3) point just to this phenomenon. If one occupational group in an industry is highly paid relative to the industry average, all categories of workers in that industry tend to be highly paid. Thus compensating wage differentials offer no overall explanation of the observed interindustry wage pattern.

A second more promising way to rationalize the observed wage differentials within the framework of the competitive model is to account for worker's abilities not captured by the available data. Obviously, the available controls for differences in worker's abilities are not exhaustive in our set of data for West Germany to say the least. Therefore, it is reasonable to expect interindustry wage differentials following from unobserved productivity differences between workers of the same broad qualification group. For the U.S. the empirical evidence on unobserved labor quality differences is ambiguous, however. Some researchers find it very difficult to attribute interindustry wage differences to unobserved labor quality differences [Krueger and Summers, 1988; Katz and Summers, 1989]. Others argue that productivity-based sorting is an important determinant of interindustry wage differences, since it is plausible that observable and unobservable ability measures are positively correlated and control-

ling for the observable ability variables reduces the magnitude of the interindustry wage variations [Topel, 1989; Murphy, Topel, 1987]. But even the existence of unobserved abilities cannot explain the large correlations between wages in any two qualification groups.

The most prominent candidate among alternative approaches explaining the interindustry wage differentials is the efficiency wage theory. Its basic hypothesis is that the productivity of workers is a function of the wage paid. Thus, it may be profitable for firms to raise wages above market-clearing levels in order to increase workers' effort. Since the relationship between productivity and wages may differ between industries, profit-maximizing behavior by firms may lead to wage differentials between industries. Stiglitz [1986] categorizes five versions of the efficiency wage model, each featuring a different reason why higher wages may increase effort. But only one type of efficiency wage models - namely sociological models based on workers' fairness considerations - may be compatible with the empirical evidence because all the other versions cannot account for the previously-mentioned large correlations between the wages of any two qualification groups within an industry. In the sociological models productivity is assumed to depend on workers' perceptions as to whether they are being paid fairly. Perceived fairness in turn depends on firms' characteristics like production technologies and monopoly rents. These characteristics differ between industries and may thus explain wage differentials. In fact, Dickens and Katz [1987a] find that wage premiums are positively correlated with profits and the capital-intensity of production while Kahneman et al. [1986] present empirical evidence that fairness considerations influence the behavior of firms in setting prices and wages. In addition, it is possible to combine the fairness models with other efficiency wage models. For example, some workers in specific industries may be able to exert much damage to their firm by shirking. Thus, they may receive high wages in order to prevent them from doing so. That is, the costs of shirking may differ between industries due to industry-specific production technologies. Internal fairness considerations

may then lead to high wages for all workers in industries with production costs sensitive to potential shirking.

Interpretations like these are robust with respect to the available data cited so far. The international similarity of inter-industry wage structures would follow from industry specific production technologies which account for industry specific costs of monitoring workers, and internal fairness considerations would suggest a high correlation between the wages of any two occupational groups within an industry. However, all these more or less theoretical considerations are waiting for an empirical test, at least for West Germany. Testing these hypotheses seems to be an important task for further research since an explanation of the observed interindustry wage pattern within the framework of efficiency wage models would have far reaching consequences for economic policy prescriptions regarding the labor market.

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