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## **ABSTRACT**

### **Wages as Risk Compensation in Germany\***

The theory of compensating wage differentials is generally accepted. Still, there has been no strong or even contrary evidence for compensating wage differentials in Germany so far. Estimating wage regressions with data of the German Socio-Economic Panel (GSOEP) within individually perceived hazards of work accidents as a risk variable, evidence for compensating wage differentials in Germany is found even though other effects may partly weaken the existing wage premiums due to risks at work.

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Keywords: Compensating wage differentials, wage regressions, work accidents

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## 1. Introduction

Imagine that you have just received a degree from a college of engineering and you can choose between two interesting job offers as a result of your job search. The offers are comparable as to all essential characteristics, e.g. promotion prospects, location of plants, working hours, and especially the wages. The only difference between the two job offers is that there are irritations of noise and an increased risk of work accidents in firm A while not in firm B. Which job do you choose?- The job in firm B, of course! The only thing firm A could do, is to compensate you for worse working conditions by paying an extra bonus.

This is the idea of the theory of compensating wage differentials, which forms part of most personnel and labor economics textbooks by now (e.g. see FRANZ 1996: 328-329, BORJAS 1996: 188-219, EHRENBURG/SMITH 1997: 247-285, LAZEAR 1998: 377-407). The seminal idea bases on ADAM SMITH's theory of net advantages (see SMITH 1976). Already in 1776 he assumed that people with worse working conditions get higher wages within a labor market equilibrium.

This theory is generally accepted. There exist several studies that confirm compensating wage differentials for dangerous work in the USA.<sup>1</sup> Two papers analyze possible compensating wage differentials in Germany (see LORENZ/WAGNER 1988, BELLMANN 1994). Surprisingly, LORENZ and WAGNER cannot find any evidence for risk compensations and BELLMANN only observes these premiums for increased probabilities of fatal but not of non-fatal accidents.

The results of this paper will show that compensating wage differentials for dangerous work do exist in Germany as well, even though other effects, such as a sorting mechanism of employees, may weaken the risk compensation. A short summary of the empirical results of

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<sup>1</sup> See VISCUSI (1993) for a summary of these studies and DORMAN/HAGSTROM (1998) for a critical view.

the German and the U.S. studies is given in Section 2. In Section 3 compensating wage differentials are analyzed on the basis of wage regressions using perceived individual hazards of work accidents as a risk variable according to the data of the Socio-Economic Panel (GSOEP). The paper closes with a discussion of the results.

## **2. Empirical results of earlier studies**

Several studies identify the relevance of compensating wage differentials for dangerous work in the U.S. labor market. VISCUSI (1993) gives a summary of these studies. Most approaches use industry wide averages of fatal and non-fatal work accidents as risk variables and find compensating wage differentials for both categories. VISCUSI (1993: 1928) mentions that „the main deficiency of industry-based data is that they pertain to industry-wide averages and do not distinguish among the different jobs within that industry“. That is why the results could rather be interpreted as industry wage premiums than risk premiums (see DORMAN/HAGSTROM 1998: 117). Following this assumption DORMAN/HAGSTROM (1998) in a recent study include industry-level variables (e.g. value added per worker and union density) and find reduced evidence for compensating wage differentials in the U.S.

Only two empirical papers deal explicitly with compensating wage differentials in Germany so far.<sup>2</sup> LORENZ and WAGNER analyze the effects of fatal as well as non-fatal accidents at work and occupational illnesses on monthly net wages in the early 1980s within five German samples. Their risk variables are based not on industry but occupational averages. They could not observe individual risks due to lack of data. LORENZ and WAGNER estimate wage

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<sup>2</sup> Additionally SCHMIDT and ZIMMERMANN (1991) use a dummy for hazardous work as a control variable in their wage regression on the basis of data from 1978 of the Zentralarchiv für Empirische Sozialforschung zu Köln. They find weak evidence for risk premiums due to hazardous work.

regressions for male full-time employees using schooling, experience (and its square), tenure, firm size as well as dummies for overhours, university degree and executive position as control variables. If compensating wage differentials could be discerned, the coefficients of the risk variables should be significantly positive. But none of the 20 coefficients fulfills this requirement. In contrast, their results even show significantly negative coefficients for non-fatal accidents at work.

BELLMANN (1994) uses the same average occupational risk variables and additionally observes their effects on the loss of life expectancy. He bases his study on the employment sample of the German Institute of Employment Research (IAB) of 1979. He restricted his approach to blue collar workers and finds significant positive effects of fatal accidents at work and non-fatal occupational illnesses of male employees, controlling schooling, experience (and its square) and change of industry. Still, in accordance with LORENZ and WAGNER, the coefficients for non-fatal accidents of work are significantly negative. Hence, there is no explicit evidence for the existence of compensating wage differentials, especially for non-fatal risks, in Germany so far.

The authors partly explain their results with their unprecise risk variables. The use of average occupational risks might be too rough an estimate for personal risks of work accidents. Strictly speaking, LORENZ/WAGNER and BELLMANN measure - due to restrictions of their data sets - inter-occupational wage differentials, which cannot be equated with compensating wage differentials for hazardous work necessarily. Some occupations are more likely to occur in huge firms and in industries with above average wages, for example.<sup>3</sup>

LORENZ/WAGNER (1988: 379) bear hope for further empirical work with better data.

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<sup>3</sup> See GERLACH/HÜBLER (1998) for evidence and explanations of firm size wage differentials and HAIKEN-DENEW/SCHMIDT (1994) for inter-industry wage differentials in Germany.

This problem is approached in the following empirical study, where for the first time personal assessments of work accidents are included in wage regressions and are controlled by several independent variables.

### **3. Data and methodology**

The following study bases on data from the German Socio-Economic Panel (GSOEP), a yearly sample survey of persons living in Germany.<sup>4</sup> Some limitations are made for the sample of this study. Only male full-time employees of 1995 are observed. The observation period is restricted to 1995 because the risk variable is sampled only in this year. A sample size of 2460 employees arises due to this limitations.

The persons have to respond to the question whether they „are exposed to an increased risk of work related accidents“.<sup>5</sup> Three categories of answers are allowed: „applies fully“, „applies partly“ and „does not apply“. Hence, in contrast to prior studies, we have a variable for individual risks and not only industry or occupational averages of risks. Though this variable is based on a subjective perception, its meaningfulness is considerable. It can be argued that in reality employers recompense only perceived increased risks.<sup>6</sup> A certain disadvantage of this risk variable consists in the fact that it is only an ordinal variable. Hence, it is not possible, as in other studies, to make quantitative statements with regard to returns to a percentage increase of the probability of work accidents.

Several other independent variables are included in the regression in order to take into account further wage determinants. The age and its square, tenure, working hours and

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<sup>4</sup> The data is available at the German Institute for Economic Research (DIW), Berlin.

<sup>5</sup> See the questionnaire of the GSOEP at <http://www.diw.de/soep/soepinfo>.

<sup>6</sup> See KUNREUTHER et al. (1978) for empirically observed barriers of perception in decision making.

dummy variables for marital status, schooling degrees, vocational degrees, firm sizes, occupational status and industries form part of these variables.<sup>7</sup> This is another difference to the quoted prior German studies, which control only for a few independent variables. It should be kept in mind that inter-industry wage differentials are separated from compensating wage differentials due to this approach in contrast to many other studies.

Simple OLS wage regressions are estimated with the log of gross monthly wages as the dependent variable (LNWAGE). Except for a general computation of the whole sample, further regressions of sub-groups (blue-collar, white-collar, West-Germany, East-Germany) are estimated in order to find out possible differences between these groups.<sup>8</sup> Compensating wage differentials will be found, if the coefficients of the dummies of partly increased risk of work accidents (PARTRISK), and especially fully increased risk of work accidents (FULLRISK), are significantly positive.

#### **4. Empirical results**

The perceived risks of accidents at work are remarkable. A partly increased risk of work accidents is indicated by 38% of the employees and 17% are even affected by a fully increased risk of work accidents. The descriptive statistics of these and the other variables can be found in table 1.

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<sup>7</sup> See table 1 for a complete list of the descriptions and names of these variables.

<sup>8</sup> These distinctions are made, because blue-collar workers are much more affected by work accidents than white-collar workers and the East-German labor market differs remarkably from the West-German one, e.g. with regard to the rate of unemployment.



Table 1: Descriptive statistics of variables

<b>Variable</b>	<b>Name</b>	<b>Average</b>	<b>Standard Deviation</b>
ln(gross monthly wage) (in DM)	LNWAGE	8.321	0.358
Age (in years)	AGE	40.13	10.76
Age * Age	SQAGE	1726.3	895.8
Tenure (in years)	TENURE	11.10	9.798
Marital status (dummy for married)	MARRIED	0.742	0.438
Dummy for East-Germany	EAST	0.310	0.463
Working hours (per week)	HOURS	43.80	7.280
<i>Schooling dummies:</i>			
No school degree	NOSCHOOL	0.057	0.233
„Hauptschule“ degree (9 years)	HAUPT (base)	0.385	0.487
„Realschule“ degree (10 years)	SECONDARY	0.292	0.455
„Fachabitur“ (12 years)	SPEC-A-LEVEL	0.038	0.191
„Abitur“ (13 years)	GEN-A-LEVEL	0.127	0.333
Other school degree	OTHER	0.101	0.301
<i>Vocational dummies:</i>			
No education	NOEDUC	0.158	0.365
Vocational training	VOCATION (base)	0.724	0.447
University degree	UNIVERSITY	0.118	0.323
<i>Firm size dummies:</i>			
Less than 5 employees	SIZE1	0.046	0.209
- 5 to 19 employees	SIZE2	0.157	0.363
- 20 to 199 employees	SIZE3 (base)	0.300	0.458
- 200 to 1999 employees	SIZE4	0.252	0.434
- 2000 and more employees	SIZE5	0.246	0.431
<i>Risk dummies:</i>			
No increased risk of work accident	NORISK (base)	0.453	0.498
Partly increased risk of work accident	PARTRISK	0.383	0.486
Fully increased risk of work accident	FULLRISK	0.165	0.371

Source: GSOEP 1995, own calculations.

Table 2 shows the results of the wage regressions. Before this study focuses on the risk variable it should be mentioned that in accordance with the theory of human capital positive returns to age (as a proxy for experience), tenure, schooling and education can be observed. Furthermore, higher wages for West-German employees, for longer working hours, and for people working in huge firms are no surprising results either.

Table 2: Wage regressions of male full-time employees (absolute T-values in parentheses)

Independent Variable	Dependent variable: log of gross monthly wages				
	Whole Sample	Blue Collars	White Collars	West-Germany	East-Germany
CONST.	+7.363*** (92.19)	+7.488*** (79.46)	+6.982*** (46.63)	+7.053*** (77.38)	+7.677*** (46.20)
AGE	+0.0242*** (6.538)	+0.0226*** (5.195)	+0.0427*** (6.166)	+0.0323*** (7.812)	+0.0031 (0.390)
SQAGE	-0.00027*** (6.130)	-0.00027*** (5.155)	-0.00045*** (5.667)	-0.00035*** (7.230)	-0.00004 (0.469)
TENURE	+0.0020*** (3.220)	+0.0011 (1.414)	+0.0031*** (2.946)	+0.0018** (2.384)	+0.0009 (0.814)
MARRIED	+0.0522*** (4.459)	+0.0242* (1.724)	+0.0768*** (3.697)	+0.0787*** (5.986)	+0.0032 (0.133)
EAST	-0.363*** (27.89)	-0.330*** (19.42)	-0.401*** (19.13)		
HOURS	+0.0072*** (10.04)	+0.0066*** (7.363)	+0.0080*** (6.606)	+0.0100*** (10.92)	+0.0036*** (3.109)
NOSCHOOL	-0.0634*** (2.873)	-0.0519** (2.271)	+0.0138 (0.240)	-0.0691*** (3.226)	+0.0967 (0.568)
SECONDARY	+0.0649*** (4.849)	+0.0397** (2.351)	+0.0872*** (3.789)	+0.0503*** (3.006)	+0.0517** (2.047)
SPEC-A-LEVEL	+0.0323 (1.222)	+0.0467 (0.864)	+0.0508 (1.462)	+0.0179 (0.679)	+0.590** (2.291)
GEN-A-LEVEL	+0.0531** (2.484)	+0.0070 (0.170)	+0.0971*** (3.247)	+0.0768*** (3.024)	+0.0323 (0.807)
OTHER	-0.0748*** (4.258)	-0.0552*** (3.097)	-0.0481 (0.857)	-0.0775*** (4.480)	+0.0194 (0.073)
NOEDUC	-0.0227 (1.489)	-0.0043 (0.274)	-0.108** (2.514)	-0.0101 (0.668)	-0.0887 (1.356)
UNIVERSITY	+0.121*** (5.688)	+0.0665 (1.022)	+0.113*** (4.378)	+0.130*** (5.328)	+0.102** (2.420)
SIZE1	-0.134*** (5.828)	-0.142*** (5.625)	-0.104** (2.257)	-0.121*** (4.205)	-0.168*** (4.423)
SIZE2	-0.0761*** (5.267)	-0.0872*** (5.391)	-0.0571** (2.011)	-0.0514*** (2.853)	-0.122*** (5.040)
SIZE4	+0.0585*** (4.591)	+0.0559*** (3.617)	+0.0593*** (2.727)	+0.0638*** (4.413)	+0.0578** (2.276)
SIZE5	+0.113*** (8.291)	+0.108*** (6.286)	+0.112*** (5.028)	+0.118*** (7.833)	+0.0961*** (3.160)
OCCSTATUS	yes (11)	yes (5)	yes (6)	yes (11)	yes (11)
INDUSTRIES	yes (32)	yes (31)	yes (31)	yes (32)	yes (32)
RISKPART	+0.00069 (0.061)	+0.0167 (1.259)	-0.0228 (1.097)	+0.0016 (0.124)	-0.0138 (0.637)
RISKFULL	+0.0299** (1.992)	+0.0451*** (2.790)	-0.0416 (1.111)	+0.0323* (1.836)	+0.0100 (0.361)
R <sup>2</sup> <sub>adj.</sub>	0.618	0.413	0.616	0.608	0.440
n	2460	1476	984	1697	763

Note: \*, \*\* and \*\*\*: coefficient is significant at the 10%-, 5%- and 1%-level.

Source: GSOEP 1995, own calculations.

Much more attention should be paid to the risk variables. The coefficients of both risk variables (PARTRISK and FULLRISK) are positive within the regression of the whole sample. Additionally, the result for FULLRISK is significant at the 95%-level. Employees with fully increased risks of accident at work get an average wage premium in the amount of 3% as compared to people without increased dangers of work accidents.<sup>9</sup> The regressions of the separate groups show that this result does not hold for all subgroups. Significant compensating wage differentials due to the risk of work accidents can only be observed for blue-collar employees and in West-Germany, but not for white-collar and East-German employees. The returns due to FULLRISK are 4.6% for blue-collar and 3.3% in West-Germany, respectively. In contrast, there are even (insignificantly) negative returns to risks for white-collar. The following section discusses these results and gives an explanation.

## 5. Discussion

In contrast to the prior German studies, compensating wage differentials for increased risks of work accidents can be observed particularly for blue-collar workers and in West-Germany. The main innovation of this approach lies in the fact that for the first time an individual risk variable has been included. Therefore, compensating wage differentials can be discerned in a better way, whereas prior studies measure inter-industry or occupational wage premiums rather than strictly compensating wage differentials due to restrictions of their data sets.

Several explanations of the results can be given. First of all, a measurement error is possible.

HAMERMESH (1978) hypothesizes (and ELLIOTT/SANDY (1998) find evidence) that workers

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<sup>9</sup> In contrast to metric variables the coefficient of dummy variables must not be directly interpreted as wage returns. These coefficients (c) have to be transformed with  $g = \exp(c) - 1$  to get the exact wage premium of the dummy relative to the base group (see HALVORSEN/PALMQUIST 1980). Still, the differences with regard to the results of this study are very small.

with relative low wages, and who are thus dissatisfied with their pay, will overstate the magnitude of their risks of work accidents. Hence, the premium due to risk of work accidents could be biased downwards. Further on, a basic difference between German and U.S. labor market institutions has to be mentioned. In contrast to the U.S., an insurance against work accidents is part of the German social security system.<sup>10</sup> People are compensated ex post at least for non-fatal risks of work accidents. Hence, risky work has only partly to be compensated ex ante through higher wages by the employer and so compensating wage differentials are more likely to be observed in the U.S. labor market.

Some further explanations can be given as to the question why there is no evidence for compensating wage differentials for white-collar workers and in East-Germany. An essential assumption within the theory of compensating wage differentials is the existence of an competitive labor market. This assumption has to be regarded critically especially with respect to the East-German labor market. During the first years after the German unification many employees lost their jobs. The regional rate of unemployment was 14.9% in 1995 with an increasing tendency, as opposed to only 9.3% in West-Germany. The lack of a competitive labor market accounts for the non-existence of compensating wage differentials in East-Germany. People are content to have a job and know that there is hardly a chance to get another, possibly less risky one. Hence, it is not very surprising that compensating wage differentials cannot be found in East-Germany. Additionally, people in general and particularly in East-Germany are not perfectly mobile, whereby this effect is strengthened.<sup>11</sup>

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<sup>10</sup> See SCHAUBENBERG (1999) for the German system of occupational cooperatives as insurers against work accidents and a comparison of the German and the U.S. system.

<sup>11</sup> More than 50% of the East-German of this sample could not imagine to change their current city of residence due to job related reasons.

Table 3: Distribution of risk of work accidents within blue-collar and white-collar

<b>Risk variable</b>	<b>Blue collars</b>	<b>White collars</b>
NORISK	0.26	0.74
PARTRISK	0.50	0.21
FULLRISK	0.24	0.05

Source: GSOEP 1995, own calculations.

Another aspect might be able to explain the differences between blue-collar and white-collar workers. Blue-collar workers are much more affected by increased risks of work accidents than white-collar (see table 3). Three quarters of white-collar employees do not perceive increased risks, whereas this holds only for one quarter of the blue-collar. This aspect alone does not yet account for the fact that compensating wage differentials can be measured for blue-collar workers only. In order to explain the phenomenon it has to be kept in mind that there will always be unobserved heterogeneity with respect to the workers' ability (see HWANG et al. 1990).<sup>12</sup> This heterogeneity cannot be measured with this data, fact why an underlying sorting mechanism cannot be controlled for either. Only few jobs of white-collar workers bear an increased risk. Hence, high ability white-collar should have no problems in finding a job without increased risks. On the other hand, low ability white-collar partly have to be content with risky jobs. This leads to the assumption that compensating wage differentials cannot be observed because of the countervailing sorting effect in the staffing of the jobs with increased risks of work accidents.

This mechanism will not hold for blue-collar, because most jobs bear a certain risk and even high ability blue-collar employees have to accept increasing risks of work accidents. That is

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<sup>12</sup> There will be unobserved heterogeneity with respect to the workers' risk aversion as well. Very risk averse employees will choose jobs or occupations with less dangers of work accidents. This is another argument for relative small risk premiums due to work accidents in general. There would be bigger risk premiums if the employees would be allocated to jobs by chance.

why a sorting mechanism is of less importance for blue-collar workers and compensating wage differentials can be found for blue-collar workers rather than white-collar workers.

Unfortunately, the risk variable is included only in the 1995 data of the GSOEP and not in that of further years, so that it is not possible to estimate panel regressions. In spite of these restrictions evidence for compensating wage differentials in Germany is found in contrast to prior German studies.

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