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Regional and occupational disparities in the wages of young blue- and white-collar workers

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According to human capital theory, people who invest a specific amount of time and money in education and training should receive a fairly identical level of wages in return. Therefore, the wages of workers who have completed a three-year course of vocational training in the German so-called "dual system" represent a test of the theory. The "dual system" provides a specific form of training in which apprentices are trained in an employing firm and at vocational school.
Descriptive analyses show that average wages in different occupations differ up to 100 percent one year after finishing the training. In the paper a cross-classified multilevel model with fixed effects is used to identify specific effects of occupations and regions and to control for the heterogeneity of individual workers. The data base is the IAB Employment Sample which is a one percent sample of total employment. On the basis of this data the necessary differentiation for about 100 occupations and 327 regions is possible.
In Germany occupational structures in the labour market are more important than in other countries. In the paper a comparison to the structure of regional disparities is given. Several theoretical hypotheses are tested to explain the differences.

1. Introduction

According to human capital theory, people who invest a specific amount of time and money in education and training should receive a fairly identical level of wages in return. Therefore, the wages of workers who have completed a three-year course of vocational training in the German so-called "dual system" represent a test of the theory. The "dual system" provides a specific form of training in which apprentices are trained in an employing firm and at vocational school.

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In the paper a cross-classified multilevel model with fixed effects is applied to identify specific effects of occupations and regions and to control for the heterogeneity of individual workers. Several theoretical approaches can be used to explain the wage differences, e.g. the hypothesis of compensating wage differentials. Alternatively older approaches of labour market segmentation can be used, which could be renewed by using neo-institutional theory, which fits well into the observed reality of the labour market in Germany and in other countries. The wage differences reflect regulations of the state and of autonomous actions of the individual agents on the market.

2. Older approaches of Labour Market Segmentation

The books by Doeringer & Piore (1971) and by Lutz & Sengenberger (1974), published in the US and in Germany respectively, triggered a surge of studies on labour market segmentation, which, however, ended at about the time when a summary book by Sengenberger (1987) came out in the eighties.

Many segmentation problems have since been addressed in a new form and with new methods. For example, economic labour market research has dealt with labour market mismatch (Petrongolo & Pissarides 2001) and numerous aspects of wage differentials, e.g. between industries (Krueger & Summers 1989) or firms (Abowd, Kramarz & Margolis 1999), without establishing any connection to segmentation approaches even though such differentials could be understood with reference to barriers between labour market segments. In the following we make a case for a new beginning of segmentation analysis. In order to support our case, we will give an empirical, a methodological and a theoretical argument.

The empirical argument says that the labour market, especially in Germany, breaks down into a large number of segments. Taken as a whole, these segments have a structure which is of great importance for economic development.

The methodological argument claims that important data bases are now available which allow segmentation analysis to be made far more powerful than was possible in the studies of the "old heroes" of segmentation approaches written in the seventies. In addition, new techniques of econometric analysis have made it possible to cope with the generally assumed multi-level problem (through persons, firms and regions/industries) and non-linear dependent variables.

Finally, the theoretical argument states that there is an isomorphism between the segmentation approaches and recent studies of (neo-)institutional economics and sociology. The labour market is a classical example of the importance of institutions in the economic process. Conversely, recent analyses of institutions allow better theoretical substantiation of labour market research.

In the following we will explain the questions to be answered by an empirical study we conducted, referring to older works on labour market segmentation. The classical approaches were based on an empirical starting point. They stated that the labour market breaks down into a number of segments separated by more or less high barriers which restrict and channel the mobility of labour. The segmentation approaches subsequently sought to describe and explain these barriers.

The first generation of authors on segmentation analysis, which worked in the context of SAMF, further developed the rather unsystematic American concept of Doeringer and Piore (for a criticism see Blien 1986) and adapted it to the situation in Germany. In the US, as in Europe, the often pursued critical claim included analysing processes of discrimination, e.g. against women (Rubery 1978).

A variety of reasons were given for the existence of segmented markets. Some of these reasons were related to neo-classical analyses, especially the human capital theory, or to traditional institutional approaches which consider labour market structures to be functional for maintaining the power gap within firms. The authors could not or did not seek to develop a unified theoretical framework.

If the qualification argument is taken as a starting point for segmentation analysis, the "peripheral" workforce of a firm includes workers with "everyday qualifications". Its complement, the "core" workforce, consists of workers trained to meet a firm's specific requirements. Finally, there are workers trained for specific occupations, e.g. those who have obtained a general qualification within the framework of the German dual system of vocational training and can be employed in a variety of firms (Sengenberger 1979 & 1987).

Within the context of the segmentation approach, it was discussed whether occupational or firm-specific labour markets prevail, or whether particular combinations can be ascertained (Biehler & Brandes 1981, Köhler & Sengenberger 1983). In many cases occupational and firm-specific qualifications are combined. It is functional for the individual firms to organize their production structures in a way that matches the availability of correspondingly trained workers and, conversely, new apprenticeship occupations are constantly created to match newly introduced or integrated production procedures.

If one uses the neo-classical human capital theory as proposed by Becker (1964) to explain labour market structures and wages, the existence of mobility barriers becomes understandable. Training schemes are then regarded as investments, i.e. they generally cost money. For example, an employee who has completed a course of general training in a specific occupation will earn more in that occupation than in another because he can claim the return from the investment (and unemployment, false expectations etc. are left out of account to the neo-classical concept of market equilibrium).

According to this explanation of wage differentials, wages can be expected to be approximately equal in all occupations with comparable training durations, since these represent similar amounts of investment. Consequently, in the area of occupations with a dual vocational training, occupational wage differentials should not play a significant role and should be competed away in the longer term. The influx of young people into particular training schemes should be controlled by the advantages associated with each training scheme. Where

an occupation is more remunerative, relatively more applicants for a corresponding training scheme should put pressure on wages in the medium term. Significant wage differentials therefore indicate certain barriers between markets, which cannot be explained by the existence of training investments.

Searching for wage differentials that are stabilized in the longer term in occupational labour markets thus comprises a test for the existence of a specific form of labour market segmentation. In order to investigate a sufficiently homogeneous population, the basic criterion will be that the employees included in the test have completed an in-firm vocational training programme. The test conducted below goes beyond the classical approaches of labour market segmentation in so far as these were orientated towards the human capital concept. On the other hand, it reproduces the "spirit" of these approaches because it investigates the importance of market segments.

3. Data and Methods

The data basis is provided by the IAB Employment Sample. This is a one per cent sample of all employees subject to social insurance contributions. The employment statistics measure with particular exactness the wages paid. The data stem from administrative notifications in the context of the German social security system. These notifications are of a high degree of exactness because they are associated with pension claims (for details of the data basis see Bender et al. 1996). The large size of the sample allows the analysis of occupational details at the level of the first three digits of the occupational code.

Such a comprehensive data basis was not available for the first generation of studies on segmentation. The authors had to be content with smaller samples which did not permit the same degree of exactness, especially with respect to occupations.

The analysis assesses the income earned by individuals one year after completion of a vocational training scheme in western Germany. In order to ensure that only longer-term differentials are recorded, a period of 10 years (1985 to 1994) is selected. Individuals are usually recorded once only, i.e. after completion of their training. Only people who have completed two training schemes in succession can be taken into account twice. Atypical cases are excluded by limiting the age range to 16 to 28 years.

Since the seventies the expanded Mincer equation has proven its worth for income analyses. The following model is estimated (simplified):

$$\ln W_{irbt} = \beta_0 + \sum_{z=1}^{23} \beta_z^x X_{zirbt} + \lambda_r + \alpha_b + \delta_t + \omega_{irbt} \qquad (1)$$

where ln is the natural logarithm, W_{irbt} is an average income per calendar day of employment deflated by the price index for western Germany (with 1995 as the base year), X_{irbt} is a set of 23 controlling variables not shown in detail here which is available in the employment sample (gender, age, age squared, occupational position and firm size), $?_r$ is a fixed regional effect, a_b is a fixed effect for the particular apprenticeship occupation, δ_t is a fixed effect for the period t

and ω_{irbt} is the usual impurity term. An identifying restriction has been used for each set of dummy variables/fixed effects included so that each fixed effect measures the distance to the sample mean. In the following example of the 101 fixed effects for apprenticeship occupations:

$$\sum_{b=1}^{101} g_b \alpha_b = 0 \qquad (2)$$

g_b is the share of all persons with the respective apprenticeship occupation in the sample. An identifying restriction has been used for each set of dummy variables/fixed effects included so that each fixed effect measures the distance to the sample mean. This approach is a preferable alternative to the technique used by Krueger & Summers (see Blien & Wolf 2002) because the standard errors of the estimate are correctly calculated. Since it also includes fixed effects for 328 regions (districts), the model employed here may also be termed a cross-classified multi-level model with fixed effects (Blien 2001, Chapter 7).

4. Empirical results: Occupational wage differentials

Table 1 shows the 10 occupations with the highest earnings and the 10 occupations with the lowest earnings with the mean normalized to 100. The results for the other occupations and for the controlling variables are not shown here due to lack of space. Without including controlling variables, the differentials between the highest and lowest paid occupations after completion of an in-firm vocational training programme are nearly 100% (Hofbauer 1981, Engelbrech & Nagel 2002), in the multivariate analysis they are still over 50%.

Table 1:
Extreme wage values after completion of an in-firm vocational training programme
Fixed effects for occupations as a deviation from the mean value,
other structural variables and fixed effects for periods and regions controlled.

Code/ Occupation	Coefficient	T Value	**Code/ Occupation**	Coefficient	t Value
452 Roofers	0.208	9.810	901 Hairdressers	-0.324	-33.640
694 Insurance brokers	0.212	14.660	011 (Farmers)	-0.226	-7.000
172 Platemakers	0.221	8.680	352 Garment sewers	-0.215	-12.580
062 Forest workers	0.222	5.540	053 Florists	-0.214	-12.570
483 Tilers	0.224	7.780	684 Druggists	-0.198	-5.420
482 Insulators/sealers	0.242	6.380	351 Tailors	-0.191	-7.190
732 Post distributors	0.243	9.200	913 Guest attendants	-0.180	-9.960
174 Rotogravure machine mind.	0.272	10.840	682 Sales assistants	-0.158	-29.100
312 Linepersons	0.296	20.270	911 Restaurant merchants	-0.147	-10.070
804 Chimney sweepers	0.361	8.710	912 Waiters	-0.142	-6.130

N = 30570 employees. All coefficients are significant at the 1% level.

The results for the fixed occupational effects a_b show that there are considerable wage differentials in the Federal Republic of Germany which persist over a ten-year period and therefore cannot simply express shocks and transient imbalances in the labour market. As the occupations included in the analysis require comparable amounts of training investment, the differentials cannot be explained by the neo-classical human capital theory.

The dual system of vocational training is a peculiarity of the German economy which constitutes an advantage at international level. It allows a more in-depth training of the rising generation of workers which is matched to production requirements. The productive potential thus created is functional for the manufacturing of goods in the segment of the world market in which the German economy is specialized, i.e. relatively expensive, high quality goods.

There have been frequent attempts to establish the German dual system in other countries, but to little avail. The reason seems to be that a large number of requirements have to be met which are not met by other countries. One of these requirements is a system of occupational labour markets, and additional indications for the importance of such a system have been provided here.

5. Empirical results: Regional wage differentials

Besides occupational wage differentiation there are also wage disparities with respect to regions. The distribution of fixed effects for the 328 western German districts is shown in Map 1 and the extreme values are presented in Table 2. The estimates of the fixed effects are based on the model of equation (1). Again, a constraint was included, which facilitates interpretation. The fixed effect measures the difference of a wage to the mean of the population, while controlling for all the other included variables and fixed effects.

There are remarkable wage differentials. A possible hypothesis for an explanation is provided by the wage curve approach developed by Blanchflower & Oswald (1994). A wage curve describes wages as a decreasing function of the regional unemployment rate. It has been shown that there are effects of unemployment on wages in Germany (Baltagi, Blien 1998). In our case, however, the regional unemployment rate is not significant. A visual inspection of Map 1 suggests a slightly different hypothesis, that employment growth is the driving force behind regional differentiation. In Germany the better developing regions are concentrated in the South. More analyses will be necessary to test this modified wage curve.

Map 1: Fixed effects in a wage regression for young trained workers

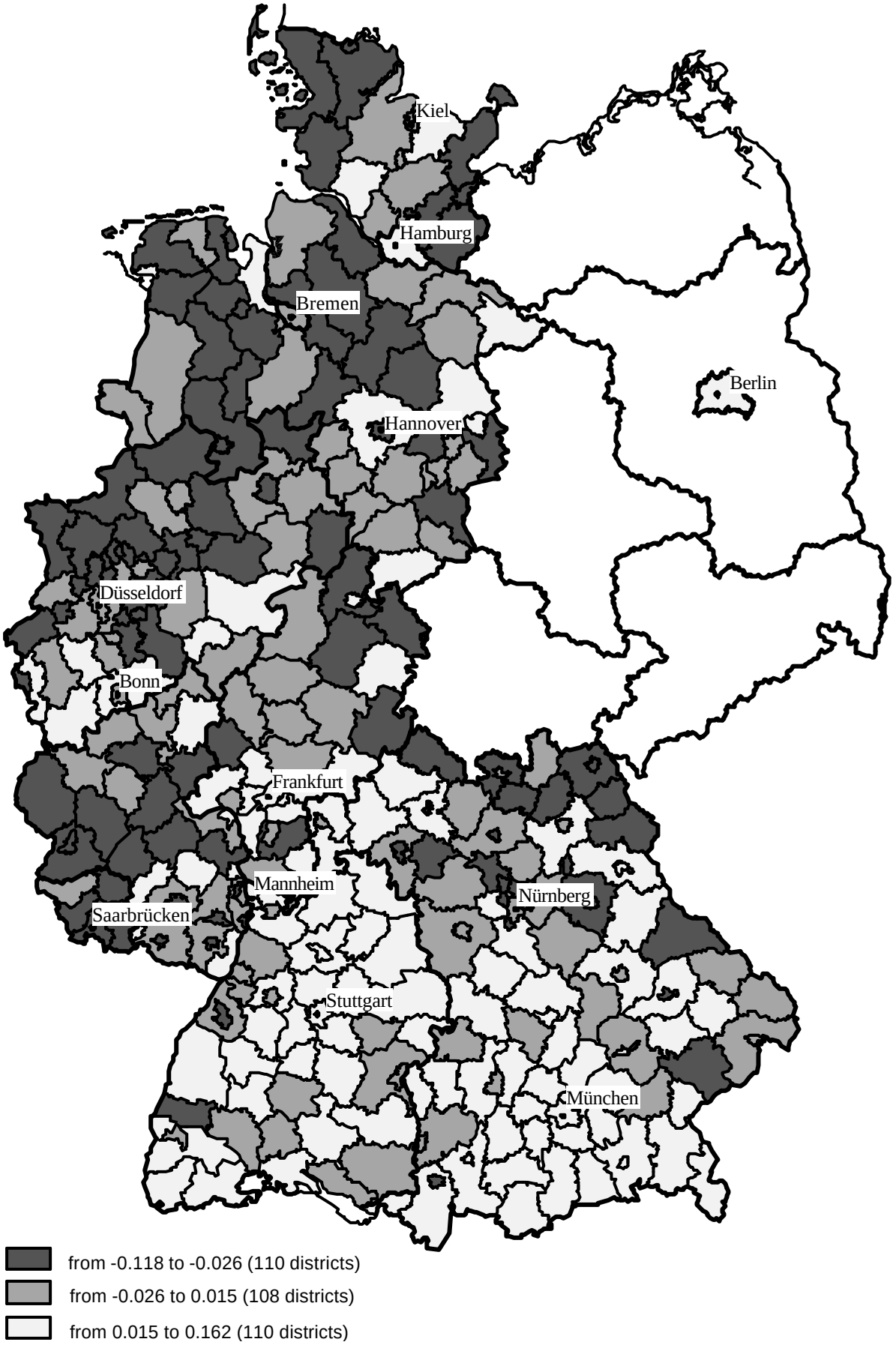

Table 2:

Extreme wage values after completion of an in-firm vocational training programme

Fixed effects for regions as a deviation from the mean value,
other structural variables and fixed effects for periods and regions controlled.

	Coeff.	t-value		Coeff.	t-value
06438 Offenbach	0,088 ***	4,050	10043 Neunkirchen	-0,115 ***	-3,460
09278 Straubing-Bogen	0,089 *	2,200	05916 Herne, Stadt	-0,114 ***	-3,730
06433 Gross-Gerau	0,091 ***	4,180	03405 Wilhelmshaven, St.	-0,113 **	-3,170
09188 Starnberg	0,097 **	2,710	09478 Lichtenfels	-0,110 **	-2,670
09777 Ostallgaeu	0,100 ***	3,790	09475 Hof	-0,106 ***	-3,170
03402 Emden, Stadt	0,100 **	2,730	09473 Coburg	-0,096 **	-3,060
09181 Landsberg a. Lech	0,106 *	2,290	05370 Heinsberg	-0,092 ***	-3,780
09279 Dingolfing-Landau	0,115 ***	3,980	03458 Oldenburg	-0,091 *	-2,380
09186 Pfaffenhofen a.d. Ilm	0,122 **	2,850	09565 Schwabach, Stadt	-0,089	-1,770
09175 Ebersberg	0,154 ***	4,080	05974 Soest	-0,078 ***	-3,840

N = 30570 employees significant at the 0,1% (***), the 1,0 (**), the 5 (*) level.

6. Some concepts for a new theoretical substantiation

The human capital theory often provided a starting point for segmentation approaches. As it cannot be used at least directly in the present case, other explanations have to be sought. Space limitations do not allow a sufficient discussion of such explanations, e.g. through compensating differentials or through individual heterogeneity. According to the last explanation, there might be a sorting of more or less able individuals into different occupations. Of course it would be necessary to follow these explanations and do more empirical research testing different hypotheses.

Here, we propose to employ neo-institutional concepts to substantiate a reformulated segmentation approach. Institutionalism deals with the formation of "rules" for the actions of economic agents and seeks to explain these actions (North 1992, Richter & Furubotn 1997). Such rules may be either formal, i.e. set by the state, or informal, i.e. spontaneously and tacitly observed by the economic agents without sanctions by a central authority.

It appears to be obvious that the system of vocational training and the structure of the occupational labour markets are fields of application for institutional analysis. The definition of apprenticeship occupations is a task of the state which is pursued in close co-operation with the social partners. Thus this is a formalized rule. The occupational careers of the trained workers follow market processes, which, however, are structured by informal rules. Jobs are created in view of qualification contents associated with particular occupational labour markets. It is not surprising that the German dual system cannot be successfully established in other countries, since it is connected to a large number of institutional requirements which are not met in other countries. The German system of vocational training is part of a possible variant of the institutional framework of an economy to which other elements are comple-

mentary. Richard Freeman (2001) and Hall & Soskice (2001) point out the importance of such complementarities and the fact that institutional differences between economies with similar unemployment rates can be considerable. The approach used in the present paper to analyse occupational labour markets differs from studies of occupational sociology which particularly draw on M. Weber (Weeden 2002).

7. Conclusion

The three arguments in favour of a revival of the segmentation approaches mentioned in the second section of the article have been developed briefly here: at least in occupational labour markets there are wage differentials which cannot be explained by training investments; powerful econometric methods and new data sources permit investigations on a scale which was not previously possible; and finally, theoretical approaches to explain institutions allow investigations to be conducted from a new perspective.

This could lead to an extensive research programme. The perspective on occupational wage differentials chosen here would only cover a small section of that programme. If one keeps to wage differentials, the differences between firms could be further investigated using a variant of the methodological arsenal developed by Abowd et al. The occupational careers of workers would have to be analysed employing longitudinal research and social mobility approaches. In this context, occupations are not simply those units which are traditionally organized into the categories of official statistics, but units which can be changed with relative ease. This would involve an occupational sociology or economy (see Velling & Bender 1994) based on the application of a novel segmentation concept.

Analyses of institutional labour market regulations would have to be either the basis or the result of the studies, depending on the investigation approach taken. Such analyses would also have to include normative processes (see Blien 2002) and the use of economic power, which has been of traditional importance in the segmentation approaches.

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