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**Wage Discrimination and Occupational  
Segregation of Foreign Male Workers  
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**Johannes Velling**

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# **Wage Discrimination and Occupational Segregation of Foreign Male Workers in Germany**

by

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## **Abstract**

We analyze wage discrimination against foreign male workers in Germany with respect to different nationality groups and focused on its interaction with occupational segregation. We found evidence of strong occupational segregation, which we mainly attribute to institutional factors but also to different endowments with human capital. For the measurement of wage discrimination itself we applied a tobit estimation procedure to the wage equation and carried out the usual Blinder/Oaxaca decomposition in the second step. We found a slight discrimination against all foreign male workers together, but considerably greater discrimination for some nationality groups such as East Europeans and persons from the Middle and Far East. The additional consideration of occupational segregation did not affect these results much. However, by far most of the wage differentials between Germans and foreign nationality groups could be attributed to different endowments with human capital.

**JEL-Classification:** F22, J15, J31, J71

**Keywords:** Discrimination, occupational segregation, foreigners

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# 1 Introduction

Discrimination is certainly one of the most controversial issue in studying the labour market performance of minority groups and of women. From a theoretical point of view, the seminal work of Becker (1957, rev. 1971) and the many theoretical articles that followed (see the survey by Cain 1986) have contributed to a better understanding of the phenomenon of discrimination. However, an empirical measurement of the extent of discrimination existing in the labour market has yet not been satisfactorily performed with a wide range of estimates in empirical studies. This is mainly due to the difficulty involved in making an accurate distinction between the impact of individual labour market characteristics and the impact of discrimination on labour market outcomes.

While most empirical studies concentrate on discrimination with respect to wages, discrimination can also affect other labour market outcomes. In particular, discrimination may take place in the hiring process, with respect to occupational attainment, and to job advancement. Those kinds of discrimination also lead to lower average wages for the group concerned, although the particular group might be payed the "same wage for the same kind of job". Whereas a broad definition of discrimination would include this kind of discrimination, "pure" wage discrimination would ignore it.

This study focuses on discrimination against male foreign workers with different nationalities in Germany. In contrast to most studies in the literature, the group under investigation here is not identified by race, ethnicity or gender, but by nationality. Whereas many discrimination issues about race and ethnicity may be extended to include nationality, there are some institutional regulations and some so-called pre-market factors which make a special treatment of nationality groups necessary. This is mostly due to the fact that many foreigners are immigrants. Those immigrants are usually subject to the restrictive German rules of labour market access. Many of these people have acquired an education and training in their home country which is only partly transferable to the German labour market and is frequently assigned a lower value by the market. Since the importance of these factors vary by nationality, the study will be based on a disaggregated analysis of 14 nationality groups.

Based on the fundamental methodology developed by Blinder (1973) and Oaxaca (1973) there have been a lot of empirical studies which tried to determine the degree of wage discrimination against women and racial minorities. Most of the studies focused on discrimination in the American and British labour market (see the surveys of Cain 1986 and Blau/Ferber 1987, see also Stewart 1983, Gill 1994). The empirical evidence on wage discrimination in Germany is, however, relatively small. There are three studies by Gerlach (1987), Licht/Steiner (1993) and Diekmann et al. (1993)

which focus on wage discrimination against women. The only study analysing wage discrimination against foreigners is the latter study by Diekmann et al. (1993) who find a modest discrimination against foreigners. However, this study suffers from methodological problems: The authors do not distinguish between nationality groups, and they base their analysis on total net individual income rather than individual labour income. Furthermore, they treat income as a continuous variable in an OLS estimation although the underlying data stems from the German labour force survey where income is coded in categories and is censored from above.

There are some more German studies based on the Socio-Economic Panel which compare the labour income of German workers and workers from different guest-worker countries (Seifert 1994) and also analyze in addition the assimilation of foreigners from guest-worker countries with respect to wages (Dustmann 1993, Pischke 1992, Schmidt 1992, Licht/Steiner 1994). However, none of these studies analyze the aspect of discrimination itself<sup>1</sup>.

In contrast to the study by Diekmann et al., this study could base the analysis on a dataset which provides accurate information on wages. Due to the high number of observations and detailed information on the nationality of the worker, it was also possible to evaluate the issue of discrimination separately for different nationality groups. This distinction turned out to be of crucial importance. The high number of observations also enabled us to analyze the impact of occupational segregation in detail; however, though we find considerable extent of occupational segregation, it does not seem to influence the discrimination results much.

The remainder of the study is organized as follows: Section 2 provides some information on the institutional framework behind the employment of foreign workers in Germany and the extent of institutional discrimination implied by these regulations. Section 3 gives the empirical results on discrimination. First the dataset is described in detail and absolute wage differentials for men and women are shown based on quartiles of the respective wage distributions. Then empirical evidence on the occupational segregation of foreigners is related separately by nationality group. Based on a specially designed econometric model the issue of wage discrimination is evaluated empirically, first using a likelihood ratio test of equality of parameters and, secondly, the Blinder/Oaxaca decomposition. Section 4 summarizes the results and draw conclusions.

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<sup>1</sup> According to the assimilation hypothesis which dates back to Chiswick (1978), recent immigrants earn less than comparable natives. This is not due to discrimination, however, but to the devaluation of the human capital they acquired in the home country. Chiswick further assumes that immigrants invest more heavily in their human capital so that they finally earn even more than comparable natives.

## 2 Discrimination against foreigners in Germany: Institutional factors and discriminatory behaviour by employers

Arrow (1973) defines discrimination as “the valuation in the labour market of personal characteristics of the worker that are unrelated to productivity“. This definition clearly indicates the need to separate productivity factors from discrimination factors. However, it does not say anything about the types of discrimination which may lead to this different valuation given the same productivity. As mentioned earlier, the most important labour market outcomes which could be affected are - according to the different stages in the employment process - the hiring process, occupational attainment and job advancement, and finally the wages. Since discrimination with respect to the first three factors leads to different wages even if productivity does not differ between workers, these kinds of discrimination must also be taken into consideration when only wage discrimination is under investigation.

For the German case, it is important to note that a great deal of discrimination already takes place implicitly via institutional regulations. New immigrants from overseas countries are particularly affected by this. Thus, German law stipulates in principle that any foreigner who wants to work in Germany needs a work permit which will be granted after certain requirements are fulfilled. Only some subgroups are exempted from this rule. In particular, these subgroups are:

- Foreigners from other countries of the European Union or from the European Economic Area (EEA).
- Foreigners with a residence title called *Aufenthaltsberechtigung* (requiring among others a duration of stay of eight years and a secure subsistence).
- Foreigners in certain types of occupations (artists, athletes, journalists, some scientists, etc.).

For foreigners who do not belong to one of these groups, there are two types of work permits. The *general* work permit is restricted to the employer (or at least to the local labour market) and only allows the type of job it is issued for. It usually applies to new migrants. The *special* work permit does not have a factual or spatial restriction, but it usually requires the individual work between four to six years in the German labour market or, alternatively, possess a German education. If one of these requirements is fulfilled, the foreigner has a claim towards a special work permit.

For the *general* work permit, the so-called *native privilege* has to be observed. It says that the work permit may only be granted if no German or other privileged foreigner

(foreigners who are exempted from the requirement of a work permit) is available for the job concerned. As a rule, the work permit is generally refused to those foreigners who would establish their right of residence only by starting a new job in Germany (that means no family members, asylum seekers or refugees). However, certain groups of foreigners have a better chance of getting by the native privilege barrier:

- Foreigners from other industrialized countries.
- Foreigners who are employed not more than three months the year (seasonal workers).
- Foreigners in certain types of occupations (language teachers, speciality cooks, some social workers, workers in the nursing sector, and some scientists).

The institutional regulations just presented are mainly aimed at protecting the natives in the labour market. However, they also implicitly lead to the following kinds of discrimination:

- Hiring process: Foreign immigrants who come from countries outside the EU and the EEA have more problems finding a job since they need a general work permit. For foreign immigrants from non-industrialized countries it is even more difficult to get a general work permit (as well as for the other non-privileged groups).
- Occupational attainment: There are certain kinds of occupations which are more easily accessible to foreign immigrants.

Table 1: Nationality Groups by Immigrant Cohorts (in %)

Immigrant Cohorts	Nationality Group														total
	TU	YU	IT	GR	E	PO	AU	OI	EE	AF	NE	FE	ON		
<i>Duration of Stay</i>															
up to 1 year	3	3	3	3	1	3	4	10	23	16	8	15	14	6	
1 to 4 years	6	4	6	10	4	6	7	13	24	16	17	26	27	10	
4 to 8 years	4	2	5	3	1	5	6	12	13	13	30	18	19	7	
8 to 15 years	14	8	13	7	5	9	13	16	14	18	19	26	17	13	
more than 15 y.	34	59	40	44	55	46	43	25	15	24	9	5	13	35	
Born in Germany	10	9	14	14	18	8	13	13	4	1	3	0	5	10	
Immigr. as child	29	14	19	19	17	24	13	10	7	13	13	9	6	19	
Sum	100	100	100	100	100	100	100	100	100	100	100	100	100	100	

Notice: Compare text for acronyms.

Source: Own calculations based on a 70% subsample of the German labour force survey, April 1991.

Both implicit types of discrimination by law have the effect that foreign immigrants from certain countries can only choose between certain types of jobs and occupations. However, only a small portion of the foreign labour force are recent immigrants, the majority either having lived in Germany for many years or being part of the second generation of foreigners who were born or have at least has grown up in Germany. In 1993 about 2.75 million foreigners were working in Germany, but only 6.3% had a general work permit and 32.1% had a special work permit. However, as shown by table 1, in some nationality groups the percentage of recent immigrants can be quite high. Implicit institutional discrimination is of considerably greater importance to these groups.

Whereas German legislation affects the occupational structure of the foreign workers, it does not influence the wage-setting process itself. That means that, at least from the institutional side, there is nothing causing "pure" wage discrimination.

Implicit institutional discrimination may be coupled with employer discrimination. In a recent study, Kenney/Wissoker (1994) analyze the discriminatory hiring practices of American employers. Using the so-called audit methodology, they find that Hispanic job-seekers are discriminated in all different phases of the hiring process compared to Anglo job-seekers. Gillmeister et al. (1989) find for Germany that nationality plays a crucial role in the hiring process. However, it is not clear whether the probable discriminatory behaviour of some employers affects the labour market participation of foreigners itself or whether it leads to a selection of certain kinds of jobs and occupations. The evidence for Germany shows that the participation rate among foreigners does not deviate much from that of Germans<sup>2</sup> with comparable characteristics.

Moreover, the legal possibilities for employers to pay different wages to Germans and foreigners are limited. The wage contracts negotiated between employer associations and trade unions do not distinguish between Germans and foreigners. According to the Federal Ministry for Labour and Social Affairs, 90% of all employees work in industries with collective wage agreements. There is in general, however, still room for wage discrimination, even when the employment relationship is governed by a collective wage agreement: Germans may be classified in a higher wage group and they may receive greater fringe benefits (see also Gillmeister et al. 1989). Nevertheless, the scope for legal wage discrimination seems to be limited<sup>3</sup>.

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<sup>2</sup> The participation rate of foreigners is actually slightly higher than for Germans. This result, which applies to men and women, comes through even stronger when a group of control variables is introduced. The only exceptions are foreigners from East Europe and non-industrialized overseas countries who face the restrictive labour market access to its full extent (see Velling 1994).

<sup>3</sup> It should be noted that some groups of foreign workers (like seasonal workers and contract workers) are not eligible for social security in Germany, which lowers the wages employers have to pay. The empirical analysis in section three does not include these groups.



## 3 Empirical evidence on wage discrimination in Germany

### 3.1 Wage Differentials by Foreign Nationality

The empirical analysis is based on a subsample taken from the so-called Historical File kept at the Bundesanstalt für Arbeit (Federal Employment Service) in Germany. The History File is derived from the insurance accounts for all employees who were eligible to receive social security after 1975, which covers about 80% of total employment in Germany. It consists of all entries in these accounts which were recorded in the fifteen year period, in particular the initial registration and termination of each employment relationship, changes and interruptions in these employment relationships, and the mandatory declaration of basic employment data at the end of each year (see Velling/Bender 1994).

For research purposes, a one percent sample has been taken from this dataset (IAB-sample). Even this sample taken from the Historical File contains about 460 thousand cases over the period of fifteen years. In the present study, only data for the year 1989 is used, thus producing a total of about 230 thousand individuals. For each individual, the data on this initial entry in the social security account in 1989 are used. For individuals who did not leave their job during this year (about 190 thousand persons), this entry corresponds to the annual declaration each employer has to make at the end of the year. For all others, the first interruption or termination declaration in 1989 is used. Each declaration contains information on age, sex, general education and vocational training, occupational status, nationality, branch of industry, place of work, occupation, full-time/part-time employment, actual apprenticeship, and gross earnings for the period covered. In addition, two other pieces of information could be used: First, by aggregation, the number of all employees of a single employer in the Historical File who are eligible for social security could be determined and added to the individual data as a proxy for firm size. Secondly, by using the retrospective information in the Historical File, the date of first entry in the Historical File could be used. If the year of first employment was prior to 1975, this variable had to be treated as left-censored, which is indicated by a dummy variable.

Compared to survey data on wages, the *monthly wage rate* contained in the Historical File can be considered to be of extraordinary quality and precision since it is the basis for the calculation of the amount of old age pension after retirement (Cramer 1986). The high quality of the wage data, however, is crucial to an accurate measurement of wage discrimination. Nevertheless, there are two characteristics of the wage data, which have to be observed. First, there is no information on the weekly hours worked, but only on full-time and part-time employment. The range of part-time employment is between zero and somewhat less than full-time working hours, so we

decided to completely dispense with the analysis of part-time workers<sup>4</sup>. In addition to this, all apprentices were dropped from the sample<sup>5</sup>. Secondly, the wages are censored from above at a level of DM 6,100. This censoring is caused by the fact that contributions to social security must only be paid for that part of the wage which lies below the so-called *Beitragsbemessungsgrenze* (contribution assessment ceiling). Consequently, the part of the wage exceeding this ceiling is not reported. This censoring does not affect the calculation of percentiles (as long as the ceiling lies in the upper percentile), but it does affect the calculation of the moments of the wage distributions as mean and variance. Therefore, a tobit procedure is required to overcome this latter problem as shown later.

The other central variable is the nationality. Nationality is coded in the Historical File with three digits distinguishing among about 150 nationalities altogether. It was therefore necessary to group nationalities. The grouping conducted in such a way that we ended up with 14 foreign nationalities. The grouping was conducted according to the following three considerations:

- The different *institutional* regulations depending on nationality necessitate the separation of EU nationalities, nationalities of other industrialized countries (OI) and all other countries. A further institutional aspect is the easier labour market access for foreigners with long durations of stay who are concentrated among the former “guest-worker“ countries (see table 1 above). Those foreigners with guest-worker nationalities<sup>6</sup> and who have recently entered the labour market consist mainly of second generation foreigners or recently immigrated family members. Either group is subject to an easier labour market access.
- *Education* and *skills* acquired in the home country have different degrees of difficulty in terms of their transferability to the German labour market. This is especially true of *language* skills. Austrians (AU) are therefore regarded separately<sup>7</sup>. Moreover, the average human capital of a nationality group is highly

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<sup>4</sup> The wage of full-time employed workers still contains some variation, since the working hours per week may still be in a range between 35 and 40 hours. Also overtime and shift premiums may distort the comparison of wages, especially if it overproportionally accrues to foreign workers. Nevertheless, we think that this kind of measurement error in the data is not large enough to affect the results on discrimination considerably.

<sup>5</sup> We also did not include apprentices since wages of apprentices comprehend a (negative) compensating wage differential for the accruing training costs.

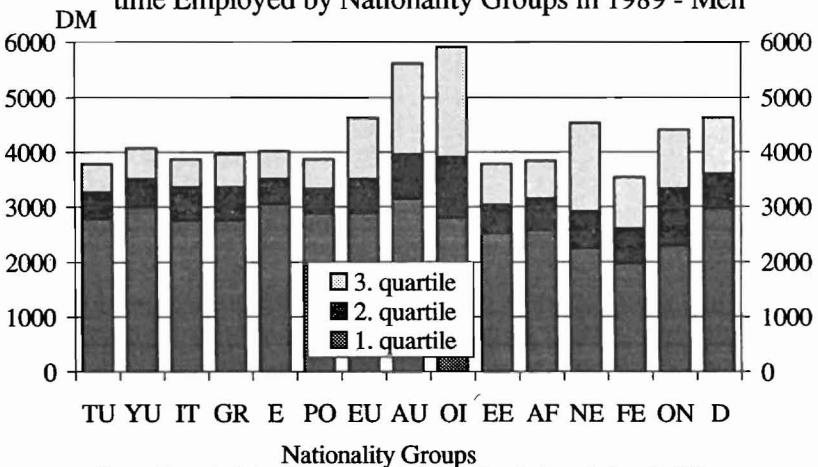
<sup>6</sup> The guest-worker nationalities are Turkey (TU), (former) Yugoslavia (YU), Italy (IT), Greece (GR), Spain (E), and Portugal (PO).

<sup>7</sup> The Swiss could also have been analyzed separately. However, the number of Swiss employees working in Germany is tiny, and not all Swiss have German as their mother tongue.

important with respect to statistical discrimination<sup>8</sup>. This is one of the reasons for separating Asians into relatively highly qualified Middle Eastern persons (NE) and less qualified Far Eastern persons (FE).

- The argument on discrimination originating from personal prejudice is that the dislike of foreigners who belong to another ethnic group or to another culture leads to certain discriminating behaviour which could eventually have the effect of lower wages (Becker 1971). Those foreigners may also have more problems assimilating. Both arguments suggest a need for separate treatment of nationalities with different ethnicities and different cultures. Therefore, overseas nationalities are divided into Africans (AF), Middle Eastern people, Far Eastern people and foreigners from other countries (ON). East Europeans (EE) form a reference group.

Figure 1a: Distribution of Monthly Wages among Full-time Employed by Nationality Groups in 1989 - Men



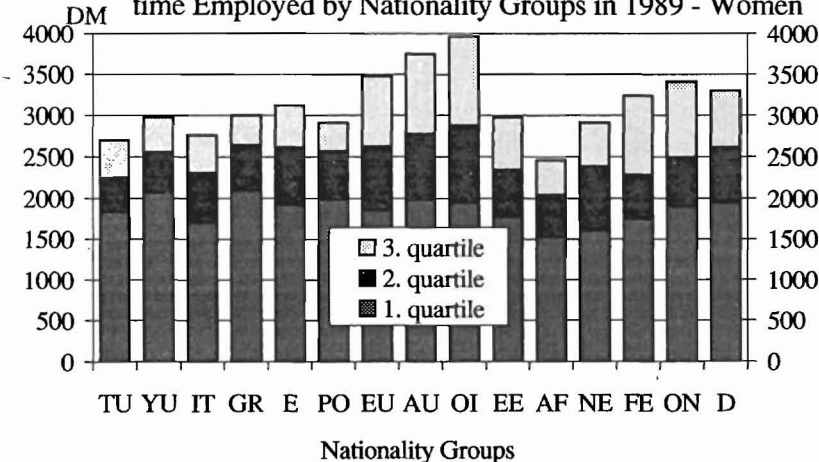
Source: Own calculations based on a particularly designed subsample from the IAB sample of the Historical File; see table 3 for the abbreviations of nationality groups.

In figures 1a and 1b, the wage distributions of foreigners of different nationalities and Germans are compared for both genders using the boundaries of the lower three quartiles of both distributions. In no group were more than 25% censored from above, so the calculations of quartiles were not affected by the censoring problem. Figures 1a

<sup>8</sup> Statistical Discrimination is caused by the screening problem employers face in the hiring process (see Aigner/Cain 1977). One screening device is the average qualification for the group the applicant belongs to. Since the average qualification is low for most nationality groups, this might be a source of discrimination.

and 1b clearly show that the wage distribution for most nationality groups lies below the wage distribution for Germans. The differences are more pronounced for men than for women. Foreigners from industrialized countries (Austria, the European Union and other industrialized countries) apparently earn more than Germans on average, foreign women from Africa and foreign men from the Far East can predominantly be found at the lower end of the overall wage distribution.

Figure 1b: Distribution of Monthly Wages among Full-time Employed by Nationality Groups in 1989 - Women



Source: Own calculations based on a particularly designed subsample from the IAB sample of the Historical File; see table 3 for the abbreviations of nationality groups.

An interpretation of this unconditioned wage distribution, however, could easily be misleading. First, the productivity and discriminatory factors have not been disentangled yet. This will be done in section 3.3. Secondly, one has to keep in mind that part-time employment is excluded and the participation process is not considered (both of which are particularly important for women). The incorporation of the selection process of part-time employment or participation could clearly change the picture if it led to an over-representation of certain groups in the total employee population. Therefore, the total wage distributions would probably look different if the total potential labour force was included.

### 3.2 Occupational segregation

In recent studies on the measurement of discrimination, the role of occupational segregation as a source of wage differentials is emphasized. Most of these studies

consider occupational segregation in the context of gender discrimination, but some studies have extended this issue to race and ethnicity discrimination (Gill 1994, Stewart 1983). For discrimination by foreign nationality, occupational segregation can also be assumed to be of major importance. Thus, the institutional framework may already cause a selection by foreigners of certain occupations, as some occupations can be performed by new immigrants without any, or under reduced, labour market restrictions. Another reason for such a selection may be the difference in the ease of transferability of education and skills depending on the occupation. Employment in the service sector, where language skills are usually required, is not possible for most of the immigrants. Other occupations can even only be practiced with education and skills which have been acquired in Germany (e.g. lawyers, physicians, and dentists).

For this reason, it is important to know, first, the level of occupational segregation depending on nationality group is and, secondly, how occupational segregation contributes to an explanation of the wage differentials between foreigners and Germans. The level of occupational segregation can be determined on the basis of the measures for occupational segregation proposed in the literature. We will use two indices. The first one is the classical Dissimilarity Index D suggested by Duncan/Duncan (1955), the second one the G-segregation index proposed by Butler (1987) and extended by Silber (1989). The D-index is defined as:

$$(1) \quad D = 0.5 \cdot \sum_{i=1}^n \left| \frac{F_i}{F} - \frac{N_i}{N} \right|$$

where  $F_i$  is the number of employees of a foreign nationality group, and  $N_i$  is the number of German employees in occupation  $i$ . Constructing a 'Lorenz-like' segregation curve, the D-index can be interpreted as the greatest vertical distance between the curve and the diagonal. The D-index enjoys great popularity and is applied to a variety of segregation issues. This may be partly due to its easy computability and partly to the long time it has been around. One major drawback, however, is that the D-index puts equal weights to all groups. The other index used here, the G-segregation index, overcomes this problem by additionally considering the weights of each occupational group:

$$(2) \quad G = 0.5 \cdot \sum_{i=1}^n \sum_{j=1}^n \frac{N_i}{N} \cdot \frac{N_j}{N} \left| \frac{F_i / N_i - F_j / N_j}{F / N} \right|$$

The G-index corresponds to the usual Gini-index, which is widely used in the income inequality literature. It can be interpreted geometrically as twice the area lying between the segregation curve and the diagonal. Table 2 shows the values of the D-index (called Duncan) and the G-index (called Gini) for different nationalities, separately for men and women. The values shown in the table are based on two-digit occupational classifications distinguishing between 41 occupations. The same calculations have been repeated on more disaggregate levels (two digits with 86

occupations and three digits), but this only raised the magnitude of the values<sup>9</sup> and had no significant influence on the order of the nationality groups.

Table 2 shows separately for men and women that the differences in the occupational structure between Germans and foreigners are smallest with respect to the industrialized countries (which also had the highest earnings; compare figures 1a and 1b). They are the highest for the guest-worker countries (with the exception of Spain) and for Africans and Far Eastern persons. However, compared to the differences between German men and women (which are shown on the bottom line of the table), they are still low. The results hold for both indices, which are different in terms of magnitude but not in the ranking of the nationalities.

Table 2: Measures of Occupational Segregation by Nationality Group - Men and Women

Nationality Groups	Men		Women	
	Duncan	Gini	Duncan	Gini
Turkey	43.3	57.4	50.5	60.6
(former) Yugoslavia	36.6	50.8	47.9	57.7
Italy	40.3	51.5	41.3	51.1
Greece	44.9	56.1	54.4	62.7
Spain	30.6	41.5	34.7	41.2
Portugal	42.4	53.7	49.2	57.7
Other European Union	13.4	18.9	13.5	17.7
Austria	15.0	21.0	9.6	14.2
Other industr. countries	24.5	32.8	14.2	22.9
East Europe	30.3	42.2	31.8	40.5
Africa	40.6	52.4	41.2	53.8
Middle East	26.1	35.4	25.0	32.9
Far East	43.5	54.9	44.3	51.3
Other overseas countries	18.8	24.8	16.7	21.9
All foreigners	33.5	42.6	37.3	45.3
Women (compared to men)	<i>54.1</i>	<i>79.0</i>	-	-

Notice: Calculations are based on 41 occupations, which provide sensible aggregates of the 86 two-digit occupations distinguished in the 'classification of occupations'.

Source: Specially designed subsample from the IAB sample of the Historical File, data on 1989.

<sup>9</sup> See Deutsch et al. (1994) for an explanation why the indices increase with the level of disaggregation.

Occupational segregation evidently seems to be an important phenomenon with respect to the employment patterns of foreigners. However, it is a priori not clear how it is related to wage discrimination. If occupational segregation were solely caused by discrimination itself, the measurement of wage discrimination without controlling for occupational structure would include both “pure“ wage discrimination and discrimination according to occupational segregation. By controlling for occupational structure, one would isolate the “pure“ wage discrimination. Some authors, however, argue that occupational segregation is not only determined by discrimination, but also by voluntary occupational choice (e.g. Gill 1994). Therefore, it is important to disentangle these two kinds of occupational determination. Without this, the discriminatory effect of occupational segregation would be overestimated. We think this argument is particular important for the analysis of gender discrimination. However, in the present context, as we are comparing foreigners and Germans of the same gender, the role of occupational segregation which can be attributed to voluntary occupational choice should be of minor importance.

### 3.3 Econometric modelling of the measurement of wage discrimination

The usual way to evaluate wage discrimination is by using the methodology first proposed by Blinder (1973) and Oaxaca (1973). The idea is to decompose the wages for Germans and foreigners into a part which can be explained by productivity differences and the remainder, which may be caused by discrimination. A common way to approximate productivity differences is to use a Mincer-type human capital wage equation:

$$(3) \quad \ln w_{ij}^* = x_{ij}' \beta_j + \varepsilon_{ij} \quad \text{with } \varepsilon_{ij} \sim N(0, \sigma^2), E(x_{ij} \varepsilon_{ij}) = 0$$

The vector  $x$  essentially contains the standard human capital variables, such as labour market experience, education, and job tenure, but also a vector of dummy variables for each occupation which are supposed to capture the effect of occupational segregation. Equation (3) can also be regarded as a hedonic wage equation. Discrimination against group  $j$  is indicated by the significantly different coefficients  $\beta_j$ .

Discrimination may take place in either direction simultaneously, which means some coefficients for foreign workers may be higher than the coefficients for Germans and some may be lower. In order to gain an impression of the overall wage discrimination against a group, Blinder (1973) and Oaxaca (1973) recommended evaluating all explanatory variables  $x$  at their sample means  $\bar{x}$  (or sample proportion if dummy variables are used), weight these values with the estimated (unbiased) coefficients, and calculate the predicted logarithmic wages (which are identical to the sample mean

in the case of a linear relationship and a constant among the regressors as assumed here):

$$(4) \quad \ln w_j^* \Big|_{\bar{x}_j, \hat{\beta}_j} = \bar{x}_j' \hat{\beta}_j$$

$$\Leftrightarrow \overline{\ln w_j^*} = \bar{x}_j' \hat{\beta}_j$$

The difference in the mean logarithmic wage can then be expressed in the following way (Reimers 1983, Oaxaca/Ransom 1994):

$$(5) \quad \overline{\ln w_j^*} - \overline{\ln w_G^*} = \underbrace{(\bar{x}_j' \cdot W + \bar{x}_G'(I-W))(\beta_j - \beta_G)}_{\text{discrimination}} + \underbrace{(\bar{x}_j' - \bar{x}_G')(W \cdot \beta_G + (I-W)\beta_j)}_{\text{endowment}}$$

Thus, the differential between average wages can be decomposed into a discriminatory component and an endowment component which captures the different productivities of the groups considered. The matrix  $W$  determines how the differences in the coefficients in the discriminatory component and the sample means in the endowment component are evaluated. The most frequently used weighting matrix is the identity matrix ( $W = I$ ). In this case, discrimination is evaluated for the sample means of the foreign nationality group  $\bar{x}_j$ , and the productivity effect is measured using the coefficient vector of the Germans  $\hat{\beta}_G$ . This weight as well as its counterpart  $W = 0$  were first recommended by Blinder (1973) and Oaxaca (1973). However, both weights have been criticized for their arbitrariness: If discrimination really takes place,  $\hat{\beta}_G$  and  $\hat{\beta}_j$  are both distorted by discrimination, and the “market price“  $\beta^*$  must lie somewhere in between these two. Therefore,  $W$  has to be chosen so that the last term in (5) yields an approximation of this  $\beta^*$ . Thus, Cotton (1988) has suggested a diagonal matrix be used with the sample share of the reference group (here: the Germans) on the diagonal for  $W$ . Neumark (1988) has recommended considering a  $\hat{\beta}^*$  which has been calculated by using a non-discriminatory wage structure. The  $W$ -matrix in this case directly results from the last term in (5), which is equal to the estimated  $\hat{\beta}^*$ . In the present case, where the German workers count for more than 90% of total employment, Cotton’s and Neumark’s alternative specifications yield results for the measurement of discrimination quite similar to the results when using  $W = I$ . Therefore, we only present results based on  $W = I$ <sup>10</sup>.

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<sup>10</sup> We also applied first the procedure which has been proposed by Neumark and secondly a matrix  $W = 0$  (these results are available from the author on request). For the Neumark procedure, the



As mentioned above, the wage variable in our dataset is censored from above at a level of DM 6,100 (= exp(a)). Thus the observed logarithmic wage  $\ln w$  can be defined with respect to the unobserved real logarithmic wage  $\ln w^*$  as:

$$(6) \quad \ln w_i = \begin{cases} \ln w_i^* & \text{for } \ln w_i^* < a \\ a & \text{for } \ln w_i^* \geq a \end{cases}$$

Equations (3) and (6) form the standard Tobit Type I model (e.g. Amemiya 1985: 363). The likelihood function of this Tobit model is given by:

$$(7) \quad L = \prod_{y_i=a} [1 - \Phi((a - x_{ij}' \beta_j) / \sigma)] \cdot \prod_{y_i < a} \sigma^{-1} \phi((y_i - x_{ij}' \beta_j) / \sigma)$$

where  $\Phi$  and  $\phi$  are the distribution and density function of the standard normal variable. Maximizing (7) with respect to  $\beta_j$  and  $\sigma$  yields consistent estimates for all coefficients. One of the consequences of the ceiling in equation (6) is that the sample means of  $\ln w_{ij}^*$  cannot be calculated directly like in equation (3) since the  $\ln w_{ij}^*$  which are larger than  $a$  are not observable. Instead, the predicted values of  $\ln w_{ij}^*$  conditioned on the sample means of the regressors have to be applied directly, that is:

$$(8) \quad \begin{aligned} & \hat{\ln w}_j^* - \hat{\ln w}_G^* \\ &= \bar{x}_j' \hat{\beta}_j - \bar{x}_G' \hat{\beta}_G \\ &= \bar{x}_j' \hat{\beta}_j - \bar{x}_j' \hat{\beta}_G + \bar{x}_j' \hat{\beta}_G - \bar{x}_G' \hat{\beta}_G \\ &= \underbrace{\hat{\ln w}^*(\bar{x}_j, \beta_j) - \hat{\ln w}^*(\bar{x}_j, \beta_G)}_{\text{discrimination}} + \underbrace{\hat{\ln w}^*(\bar{x}_j, \beta_G) - \hat{\ln w}^*(\bar{x}_G, \beta_G)}_{\text{endowment}} \end{aligned}$$

Plugging in the tobit estimates for  $\beta_j$  and  $\beta_G$ , the wage differential can easily be decomposed into the two components.

results on the percentage discrimination against nationality groups (table 4 below) did not deviate from those with a  $W = I$  weighting matrix by more than 0.4 percentage points. The deviations in the second case were more pronounced. However, with two exceptions the qualitative results did not change: For the Turkish and the Portugese male worker, we measured a discrimination against about 10% with  $W = 0$  but no discrimination obtained with  $W = I$ . Nevertheless, for the reasons given in the text we think that the results with  $W = I$  are more appropriate to evaluate the extent of discrimination.

### 3.4 Human capital factors and the measurement of productivity

As we have defined discrimination to be that part of the wage differential which cannot be explained by productivity factors, the extent of discrimination strongly hinges on an accurate measurement of productivity itself. As stated above, productivity here is approximated by the effect of the usual human capital factors on wages. Table 3 contains the summary statistics for the human capital factors of male workers<sup>11</sup> for each nationality group, all foreigners, and Germans.

The human capital variables considered here are as follows: Labour market *experience* is measured by the difference between current age and school-leaving age. School-leaving age has been assumed to be 16 in case of no Abitur, 19 with Abitur and 24 for individuals with a university degree. For foreigners, experience captures both experience on the German labour market and experience on the home labour market (as far as persons have worked in their home country). Experience enters into the estimation equation in cubic form. *Education* is measured in three categories, *Abitur* (as the highest secondary school degree), *University Degree* (Fachhochschule or Universität), and no formal education as a reference category. In addition, *vocational training* within the German dual system is also taken into account. A further variable in this line is the *occupational status*, which distinguishes among *master craftsman/foreman*, *skilled blue-collar worker*, and *white-collar worker* (the reference group is unskilled blue-collar worker). This variable can be regarded as a cross between a qualification and a job advancement index. Finally, as mentioned earlier, we have information which year the individual was first registered in the Historical File left-censored in 1976. This information has been used to construct an index for the German labour market experience of foreigners. For foreigners who have spent part of their working life in their home country, the reciprocal of the years on the German labour market is used in the estimation<sup>12</sup>. For Germans and foreigners who exclusively worked in Germany a value of zero is applied. In addition, also those foreigners whose first year in the German labour market was before 1976 received a value of zero. Given the functional form of the reciprocal, however, this approximation should not matter too much. The variable called *yfr* (years since first registration) enters into the estimation equation quadratically in its reciprocal.

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<sup>11</sup> We concentrate only on male workers in the empirical analysis. The reason is the bias which is caused by the selectivity of the labour participation process and the part-time/full-time choice women make (see the discussion below).

<sup>12</sup> In most of these cases, this variable should be equal to "years since migration" used by Grenier (1984) in a similar study.

Table 3: Summary Statistics on (Proxies of) Human Capital Variables by Nationality Group, Foreigners and Germans (Men)

Means/Proportions*	TU	YU	IT	GR	E	PO	EU	AU	OI	EE	AF	NE	FE	ON	Foreigners	Germans
<i>experience</i>	19.6	26.4	21.7	24.1	24.8	22.8	20.5	22.3	18.6	19.4	22.3	18.9	16.9	21.0	21.5	21.2
<i>education</i>																
abitur	0.4	0.8	0.4	0.8	1.0	1.6	3.8	3.5	4.7	4.3	2.2	2.9	6.2	3.3	1.5	2.6
university degree	1.1	0.8	0.5	1.2	2.7	0.0	10.2	10.9	20.0	10.7	4.9	19.5	9.2	8.9	3.7	7.7
vocational training	20.0	44.5	26.1	22.1	38.0	23.6	49.5	64.4	42.0	49.0	25.2	28.2	25.7	40.0	31.8	70.8
<i>occupational status</i>																
master craftsman/foreman	0.3	0.2	0.5	0.5	0.7	0.8	0.5	3.3	1.1	1.0	0.0	0.0	0.0	0.0	0.5	3.2
skilled blue collar worker	24.0	46.1	26.8	21.3	37.8	27.6	28.7	34.7	16.3	33.0	26.0	17.8	19.5	31.5	29.0	36.5
white collar worker	3.0	4.7	4.9	6.1	10.9	3.6	35.9	41.1	53.3	22.8	12.3	36.8	20.3	27.2	11.7	35.6
<i>years since first registration (yfr)**</i>	6.8	7.6	8.0	5.6	7.1	5.9	6.8	6.5	5.3	5.0	6.1	5.7	5.8	6.9	6.6	-
	21.4	12.9	24.6	24.7	9.4	14.4	41.7	28.4	43.5	52.8	46.8	54.0	68.0	36.2	26.4	-
number of observations	4,123	1,774	1,360	592	405	250	763	599	276	394	365	174	369	213	11,657	105,204
thereof: censored	24	19	12	6	7	-	72	81	42	22	10	9	12	13	329	8,564

Note: \* Mean values are printed in normal type, percentages in italics.

\*\* First line: Means only apply to immigrant workers, second line: percentages of immigrant workers (= positive yfr).

Abbreviations: TU = Turkey, YU = Yugoslavia, IT = Italy, GR = Greece, E = Spain, PO = Portugal, EU = other European Union member countries, AU = Austria, OI = other industrialized countries, EE = East Europe, AF = Africa, NE = Middle East, FE = Far East, ON = other nationalities

Source: Specially designed subsample from the IAB sample of the Historical File, data on 1989.

As can be seen in table 3, human capital of foreigners varies a lot between the nationality groups. Whereas foreigners from industrialized countries (EU, AU, OI) and - with the exception of Africans - from overseas countries and East Europe have a high education on average, foreigners from guest-worker countries are all less well-educated. The general education possessed by the former group is even higher than the education possessed by Germans. The average for foreigners is characterized by a high percentage of guest-workers in the sample, which leads to a low average qualification for all foreigners as a group. The variable  $yfr$  shows a relative low variation among the nationality groups with an average German labour market of experience between 5.0 and 8.0 for new immigrants. However, the percentage of foreigners who have foreign labour market experience (the number in italics) is by far higher for the nationality groups in the columns on the right.

The human capital variables shown in table 3 have been complemented in the regression by a firm size variable to control for the well-known fact that *ceteris paribus* large firms pay higher wages than small firms (see Gerlach/Schmidt 1989, Schmidt/Zimmermann 1991, Bellmann/Kohaut 1995). In addition, the federal state the employer is located in has been used to control for regional wage disparities. Federal states are admittedly only a rough control in this perspective, and more disaggregate information would be desirable. However, federal states were the only regional information provided by the dataset. Finally, dummies for occupational groups (like in table 2) have been used in some of the estimation equations to evaluate the effect of occupational segregation on the measurement of discrimination.

Before turning to the estimation itself, a few points concerning the specification in equation (1) are in need of some further discussion: Can the described human capital variables be assumed (statistically) exogenous, i.e. not correlated with the error term, thus assuring the consistency of the estimated coefficients? How does the selectivity of labour market participation (especially for women) affect the estimation? Finally, does the meaning of the variables used to measure productivity differ between Germans and foreigners?

### *Statistical Exogeneity*

There is almost no regressor in the Mincer-type wage equation which has not been regarded as endogeneous in some study. The qualification variables are often regarded as endogeneous since current wages may have affected the investment in human capital in the past if they could have been expected at the time of the investment. We do not want to pursue this discussion here since we do not think that the resulting bias is particularly large. Moreover, the bias will be even less problematic for the measurement of discrimination if it has the same size for both groups being examined. Another problem, however, is the possible omission of some variables which are then included in the error term. With respect to foreigners, such

variables are knowledge of German language and acquaintance with German culture<sup>13</sup>. It is true that the effect of this omission will be mitigated by the inclusion of the variable “years in the German labour market“ (*yfr*); however, information about language acquisition especially during primary and secondary school age still remains essentially uncovered. In particular, we are unable to distinguish between a foreigner who immigrated in his adolescent years and a second-generation foreigner. This drawback to the data has to be kept in mind, particularly with respect to the results obtained for foreigners from guest-worker countries. The estimated coefficients of the constant and some of the regressors may suffer from bias.

### *Selectivity of Labour Market Participation*

The selectivity of labour market participation may affect the correct measurement of wage discrimination. The usual argument for the selectivity process into account in the estimation is that its omission would lead to biased coefficients when some of the regressors are correlated with the selectivity term. Some authors doubt that this bias influences the correct measurement of discrimination. Thus, Sapsford/Tzannatos (1993: 233) argue that wage discrimination is a phenomenon within the labour market and does not influence those who do not participate. However, they overlook the fact that wage discrimination may also affect the wage offers each individual receives which are relevant to the participation decision. If wage offers for non-employed are differently affected by discrimination than the wages of the employed, the omission of the non-employed could affect the measurement of discrimination.

Since we do not have any information on individuals who are not employed, we are not able to model the participation decision adequately. We therefore decided to restrict the estimations to men for whom the selectivity problem is assumed to be of minor importance<sup>14</sup>. For men, the choice between full-time and part-time can also be assumed to be less relevant, as we have restricted ourselves to full-time employment only.

### *Measurement of human capital variables*

The last problem to be discussed is the appropriate measurement of the human capital of Germans and foreigners. The question to be posed is whether the different qualification and education variables really measure the same thing for Germans and foreigners. The data set does not distinguish between a qualification which has been acquired in the home country and a German qualification. If the former qualification undergoes considerable devaluation in the German labour market (which is a major component of the assimilation hypothesis; see above), this qualification is given less

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<sup>13</sup> Ehrenberg/Smith (1991: 534) give further examples for such omitted variables.

<sup>14</sup> Although we have admittedly ignored the participation decision of unemployed men.

value by the market, thus leading to lower expected  $\beta$ 's. This, in turn, could be misinterpreted as labour market discrimination. Of course, this effect matters only for those nationalities with a relatively high portion of highly qualified workers where the transferability of qualification may be assumed to be considerably restricted. Since we have no information where qualification have been acquired, it is difficult even to estimate the bias caused by this effect for these countries. This point will be taken up again in the discussion of the results.

### 3.5 Estimation Results

Using the estimation procedure outlined in section 3.3, we estimated the Mincer-type human capital wage equation separately for each nationality group, for foreigners and for Germans. The estimation results shown in table 4 can serve as basis for examining discrimination in a two-fold way: First, a test on equality of parameters can be carried out. If the hypothesis of equal parameters cannot be rejected, discrimination will probably not be the case. Secondly, the estimated coefficients can be used to decompose the wage differential as shown in equation (8). Each procedure is discussed in the following.

At first glance, estimated coefficients are of similar size for the different nationality groups and total foreigners on the one hand and Germans on the other. There are only a few exceptions with respect to the coefficients for white collar workers and for vocational training, but in these cases the standard errors are also quite high. In general, the standard errors vary heavily with the sample size of the group under investigation. Thus, the standard errors for Germans (with 105,204 observations) are by far the lowest, with only about one-tenth of the standard errors for nationality groups on average. The group with the highest standard errors (but only 174 observations) are the Middle Eastern persons with about 30 times as high standard errors as the Germans. Consequently, the estimation results for the Germans can be regarded as quite precise. This cannot be said for the estimates of the coefficients for some nationality groups, however.

Therefore, the direct comparison of the estimated parameters hardly allows one to draw any hard conclusions about the discrimination issue without taking the variation of the estimates into account as well. For this reason, two tests have been carried out which combine both pieces of information. The first test is on the hypothesis that all coefficients except the intercept are equal for the respective nationality group and Germans. The second test also includes the restriction of equal intercepts. The null hypotheses for either test can be expressed as:

Table 4: Tobit Estimation Results by Foreign Nationality Group and Germans (Men)

	TU	YU	IT	GR	E	PO <sup>1</sup>	Foreign- ners	Ger- mans
constant	7.38 (0.037)	7.21 (0.096)	7.03 (0.102)	6.97 (0.136)	6.97 (0.127)	7.20 (0.140)	7.27 (0.028)	7.26 (0.008)
experience	0.06 (0.004)	0.08 (0.009)	0.08 (0.009)	0.05 (0.014)	0.10 (0.013)	0.11 (0.018)	0.05 (0.003)	0.06 (0.001)
experience <sup>2</sup> /100	-0.24 (0.022)	-0.28 (0.043)	-0.29 (0.043)	-0.18 (0.070)	-0.37 (0.064)	-0.43 (0.093)	-0.18 (0.016)	-0.15 (0.005)
experience <sup>3</sup> /10000	0.29 (0.034)	0.29 (0.062)	0.33 (0.064)	0.20 (0.100)	0.44 (0.093)	0.55 (0.139)	0.19 (0.023)	0.14 (0.008)
Abitur	0.15 (0.063)	-0.06 (0.068)	0.36 (0.132)	0.04 (0.133)	-0.15 (0.129)	-0.01 (0.136)	0.06 (0.023)	0.08 (0.006)
university degree	0.51 (0.048)	0.38 (0.074)	0.50 (0.112)	0.43 (0.130)	0.55 (0.088)	- (-)	0.39 (0.018)	0.42 (0.005)
vocational training	0.03 (0.012)	0.03 (0.015)	0.05 (0.021)	0.11 (0.039)	0.04 (0.030)	0.04 (0.052)	0.05 (0.007)	0.07 (0.003)
master craftsman/ foreman	0.22 (0.079)	0.22 (0.114)	0.29 (0.104)	0.26 (0.169)	0.50 (0.145)	0.31 (0.188)	0.28 (0.038)	0.33 (0.006)
skilled blue-collar worker	0.06 (0.011)	0.10 (0.015)	0.08 (0.020)	0.14 (0.039)	0.09 (0.029)	0.03 (0.049)	0.08 (0.007)	0.11 (0.003)
white-collar worker	0.02 (0.029)	0.21 (0.033)	0.24 (0.039)	0.18 (0.060)	0.24 (0.048)	0.06 (0.095)	0.28 (0.011)	0.29 (0.003)
years since first registration <sup>1</sup>	-0.31 (0.070)	-0.56 (0.135)	-0.19 (0.135)	-0.54 (0.194)	-0.69 (0.291)	-0.49 (0.321)	-0.36 (0.043)	- (-)
years since first registration <sup>2</sup>	0.17 (0.080)	0.53 (0.156)	0.12 (0.149)	0.40 (0.200)	0.76 (0.338)	0.38 (0.370)	0.20 (0.047)	- (-)
sigma	0.254	0.249	0.266	0.280	0.226	-	0.289	0.287
number of observat.	4,123	1,774	1,360	592	405	250	11,657	105,204
likelihood ratio- $\chi^2$ (24)	1509.1	700.2	866.2	367.0	265.5	-	5,694	63,427
McFadden Pseudo R <sup>2</sup>	0.766	0.821	0.755	0.667	1.183	0.355	0.549	0.565
<i>test on equal parameters</i>								
const.diff.: LR- $\chi^2$ (22)	362.0**	79.2**	137.9**	137.4**	46.7**	34.4** <sup>2</sup>	247.6**	-
const. eq.: LR- $\chi^2$ (23)	366.3**	82.4**	139.4**	139.6**	46.8**	34.4** <sup>2</sup>	249.7**	-

Note: Standard errors are in parentheses. The estimation also includes a constant, three dummy variables for firm size, and ten dummies for federal states (but no dummies for occupational groups). The test statistics for the test on equal parameters are marked by one (two) asterisk(s) if equal parameters are rejected on the 10% (5%) significance level. <sup>1</sup> OLS-estimation (because of no censoring in this case), R<sup>2</sup> shown is  $\bar{R}^2$  for the OLS estimation. <sup>2</sup> One degree of freedom less.

Source: Specially designed subsample from the IAB sample of the Historical File, data on 1989.

Table 4: (continued)

	EU	AU	SI	OE	AF	VA	HA	SN
constant	7.38 (0.134)	7.36 (0.203)	7.40 (0.207)	6.86 (0.218)	7.52 (0.179)	6.83 (0.264)	7.26 (0.164)	6.68 (0.229)
experience	0.05 (0.013)	0.06 (0.017)	0.03 (0.026)	0.04 (0.022)	0.00 (0.022)	0.03 (0.033)	-0.00 (0.024)	0.09 (0.033)
experience <sup>2</sup> /100	-0.12 (0.066)	-0.18 (0.085)	-0.08 (0.130)	-0.16 (0.113)	0.12 (0.108)	-0.06 (0.176)	0.08 (0.133)	-0.27 (0.165)
experience <sup>3</sup> /10000	0.07 (0.100)	0.17 (0.128)	0.07 (0.194)	0.21 (0.173)	-0.25 (0.160)	0.06 (0.275)	-0.16 (0.217)	0.27 (0.245)
Abitur	0.12 (0.061)	0.10 (0.085)	0.12 (0.101)	0.02 (0.086)	0.03 (0.119)	0.41 (0.182)	0.04 (0.076)	0.27 (0.165)
university degree	0.50 (0.051)	0.40 (0.069)	0.36 (0.072)	0.42 (0.079)	0.54 (0.104)	0.43 (0.104)	0.33 (0.089)	0.44 (0.120)
vocational training	0.10 (0.028)	0.05 (0.038)	0.02 (0.057)	0.07 (0.044)	0.01 (0.048)	-0.06 (0.087)	0.05 (0.052)	0.06 (0.066)
master craftsman/ foreman	0.25 (0.153)	0.31 (0.089)	0.52 (0.200)	-0.01 (0.173)	- (-)	- (-)	- (-)	- (-)
skilled blue-collar worker	0.09 (0.032)	0.15 (0.044)	0.12 (0.073)	0.06 (0.047)	0.07 (0.048)	0.18 (0.098)	0.10 (0.058)	0.17 (0.073)
white-collar worker	0.34 (0.034)	0.36 (0.045)	0.53 (0.059)	0.29 (0.056)	0.23 (0.069)	0.34 (0.087)	0.37 (0.064)	0.33 (0.088)
years since first registration <sup>1</sup>	-0.28 (0.151)	0.06 (0.241)	0.14 (0.248)	0.22 (0.198)	-0.16 (0.213)	0.34 (0.369)	0.23 (0.205)	-0.64 (0.382)
years since first registration <sup>2</sup>	0.12 (0.162)	-0.17 (0.248)	-0.21 (0.253)	-0.23 (0.200)	-0.14 (0.218)	-0.46 (0.369)	-0.37 (0.206)	0.57 (0.414)
sigma	0.300	0.344	0.322	0.329	0.299	0.350	0.326	0.358
number of observat.	763	599	276	394	365	174	369	213
likelihood ratio- $\chi^2$ (24)	541.8	305.1	243.2	205.7	218.6	162.7	282.6	145.8
McFadden Pseudo R <sup>2</sup>	0.567	0.380	0.553	0.436	0.569	0.547	0.547	0.443
<i>test on equal parameters</i>								
const.diff.: LR- $\chi^2$ (22)	33.8*	30.3	59.9**	50.7**	36.9***	56.5***	108.4***	38.6***
const. eq.: LR- $\chi^2$ (23)	33.8*	37.1**	60.4**	94.9**	44.9***	100.2***	213.2***	47.7***

Note: Standard errors are in parentheses. The estimation also includes a constant, three dummy variables for firm size, and ten dummies for federal states (but no dummies for occupational groups). The test statistics for the test on equal parameters are marked by one (two) asterisk(s) if equal parameters are rejected on the 10% (5%) significance level. <sup>1</sup> OLS-estimation (because of no censoring in this case), R<sup>2</sup> shown is  $\bar{R}^2$  for the OLS-estimation. <sup>2</sup> One degree of freedom less.

Source: Specially designed subsample from the IAB sample of the Historical File, data on 1989.



Test1:  $H_0: \beta_{jl} = \beta_{G1}$  for all  $l = 1, \dots, L$

Test2:  $H_0: \beta_{j0} = \beta_{G0}$  for all  $l = 0, \dots, L$

where  $L$  is the number of slope coefficients, and  $\beta_{j0}/\beta_{G0}$  is the coefficient for the intercept. Whereas the first test is a test for no discrimination with respect to all variables included (e.g. on different returns to education), the second test is a test for the null hypothesis of no discrimination at all. If the null hypothesis cannot be rejected, this could be interpreted as weak evidence for the absence of discrimination<sup>15</sup>.

The two tests have been carried out as likelihood-ratio tests comparing the value of the log-likelihood functions without any restriction with the corresponding values under the restriction. The test statistics are shown in the two bottom lines of table 4 for all nationality groups and for total foreigners. Those statistics which are significant at the ten (five) percent level are marked by one (two) asterisk(s).

With the exception of Austrians and foreigners from other EU-countries, equality of parameters between Germans and the respective foreigner group can be rejected at the 5% significance level in all cases. However, also for these two groups the results cannot be interpreted right away as evidence for equal parameters. For foreigners from other EU-countries, the hypothesis of equality of parameters can still be rejected at the 10% level, and for Austrians the hypothesis of equal parameters can only be not rejected if different intercepts are admitted. Thus, according to the test results, absence of discrimination in its strong definition - equal parameters with respect to all personal characteristics - seems only be possible for two nationality groups .

One has to keep in mind, that the definition of discrimination used by the test just described is quite strong since it postulates the equality of all parameters. However, it might well be that negative discrimination with respect to one variable is counterbalanced by positive discrimination with respect to another variable. The test would indicate that the parameters are not equal, but in reality an overall discrimination against the total labour force of one nationality group on average might not be the case. This question of discrimination can only be answered by carrying out the total decomposition of the wage differential as shown in equation (8).

For this purpose, the estimated coefficients in table 4 have been inserted into equation (8). Thus, two “average“ wage rates have been calculated for each nationality group:

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<sup>15</sup> As a hypothesis can only be rejected but never be confirmed, the power of the test of equal parameter is limited. If the hypothesis of equal parameters cannot be rejected at chosen significance levels, this finding could well be the result of no discrimination, but it could also be the result of the low precision of some estimated parameters, which might particularly apply to some nationality groups with low number of observations.

The predicted logarithmic wage based on the sample means of the explanatory variables and the estimated coefficients for each group, and the predicted logarithmic wage based on the sample mean for each nationality group and the estimated coefficients for Germans. This information is sufficient to carry out the decomposition into a discriminatory component and an endowment component. The corresponding decomposition is shown in table 5. The left panel shows the decomposition based on estimations which do not consider the occupational structure of the nationality groups. The decomposition in the right panel, however, is based on estimations including 40 dummy variables for occupational groups. The effect of occupational segregation can be judged by comparing the results from the two panels.

Table 5: Decomposition of Wage Differentials between Foreigners and Germans - Men (in %)

	Without Occupations			With Occupations		
	Total	Endow- ment	Discrimi- nation	Total	Endow- ment	Discrimi- nation
Turkey	-16.2	-17.4	1.2	-15.7	-16.7	0.9
(former) Yugoslavia	-10.6	-7.4	-3.2	-10.8	-7.1	-3.7
Italy	-17.8	-14.8	-3.0	-17.1	-16.4	-0.7
Greece	-17.1	-11.9	-5.1	-16.6	-12.6	-4.0
Spain	-10.0	-6.3	-3.6	-9.1	-5.9	-3.2
Portugal	-15.5	-12.7	-2.7	-14.4	-13.0	-1.4
Other Europ. Union	-0.5	-0.3	-0.2	0.1	-1.5	1.7
Austria	9.1	4.1	5.1	10.2	3.5	6.7
Other industr. countr.	4.7	3.9	0.9	4.9	1.6	3.3
East Europe	-20.8	-7.2	-13.5	-19.7	-8.4	-11.3
Africa	-15.3	-9.1	-6.2	-16.0	-11.1	-4.9
Middle East	-23.3	-3.8	-19.5	-22.6	-7.1	-15.6
Far East	-33.8	-12.0	-21.8	-34.7	-15.8	-18.8
Other overseas countr.	-15.0	-6.1	-8.9	-15.2	-8.0	-7.2
All foreigners	-13.1	-10.9	-2.2	-12.6	-11.3	-1.3

Notice: Measured as the difference between estimated logarithmic wages.

Source: Specially designed subsample from the IAB sample of the Historical File, data on 1989.

Before coming to the interpretation, one clarifying comment has to be made regarding the first column in each panel. The numbers shown are the absolute differences between the estimated "mean" logarithmic wages of foreign and German workers. For small values, this difference is approximately equivalent to the percentage wage

difference referred to the wage of Germans<sup>16</sup>. If the sample means for these wages could be used instead of the predicted wages, the two columns should show exactly the same numbers. However, in this case the predicted “mean“ logarithmic wages is slightly different since the two specifications of the estimated coefficients and  $\bar{x}$  differ. Therefore, the two specifications of the estimated foreign-German wage differentials also vary slightly.

The total wage differentials are disentangled into endowment and discrimination effects in the second and third columns of each panel. Taking all foreigners together, there is apparently almost no discrimination at all. However, if single nationality groups are considered, we find substantial (more than 10%) discrimination for East Europeans, Middle Eastern persons and Far Eastern persons. The extent of wage discrimination for the last three groups is comparable to the findings in U.S. studies on wage discrimination against black male workers (compare Cain 1986: table 13.7, Blau/Ferber 1987:- table 1). Discrimination against workers from guest-worker countries is quite moderate, discrimination against Austrians is even slightly positively. At the first glance this last result is surprising. One reason may be that Austrians working in Germany are a positively selected group, being the most mobile and flexible people in the overall Austrian labour force. Moreover, they do not suffer much from the devaluation of the qualification acquired at home since they speak the same language (they are the only group having German as mother tongue) and they benefit from existing bilateral agreements between Germany and Austria concerning mutual recognition of university and master degrees. However, this in terms of magnitude still small amount of discrimination should not be overemphasized, particularly because the test of equal parameters has indicated no significant discrimination with respect to personal characteristics.

The endowment effect is particularly important for foreigners from guest-worker countries and for Far Eastern persons and Africans. It reflects the poor average qualification possessed by these groups as shown in table 3.

The control for occupational segregation only has a minor influence on the results. This can be seen by comparing the decompositions of the wage differentials between the two panels in table 4. In general, including occupational groups in the estimation equation slightly lowers the total wage differential and also the wage differential due to discrimination whereas the endowment components are about the same on average. A part of this finding could be attributed to the fact that some of the variables already included - especially “white collar worker“ - reflect some of the differing occupational structure regarding foreign and German employment. However, we do not think that this is the main reason for the weak effect of occupational segregation. The wage discrimination we have found is apparently a matter of “pure“ wage

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<sup>16</sup> This is can be expressed formally as:  $\ln w_j - \ln w_G \approx (w_j - w_G)/w_G$ .

discrimination and not of wage differences due to occupational segregation caused by discrimination.

## 4 Summary and conclusions

We have analyzed wage discrimination against foreign male workers in Germany with respect to different nationality groups and stressed its interaction with occupational segregation. We have found evidence for strong occupational segregation which we have mainly attributed to institutional factors but also to different endowments with human capital such as language and other country-specific skills. However, we were not able to confirm a major contribution on the part of this occupational segregation to an explanation for non-productivity-related wage differentials between foreign nationality groups and Germans.

For the wage discrimination issue itself, we were able to use a dataset offering particularly high-quality wage data. This dataset also provided us with high enough number of observations and detailed enough information to allow us to distinguish between 14 nationality groups among foreigners. We had to restrict our analysis to men since the data did not allow us to consider the participation decision, which is particularly important for women.

The discrimination issue was tackled in two ways. First we compared the estimated coefficients of Mincer-type wage equations. Likelihood-ratio test for the restriction of equal parameters for each nationality group and total foreigners on one hand and for Germans on the other hand were carried out. However, the hypotheses of equal parameters could only not be rejected with some confidence for Austrians and foreigners from EU-countries (other than the guest-worker countries). In addition, if positive and negative discrimination were occurring simultaneously, rejecting equal parameters would still not indicate that discrimination was at work. We therefore carried out a decomposition of wage differentials into an endowment and a discrimination component.

For all foreigners put together, the total wage differential of 13.1 percent with respect to German males could be attributed, with 10.9 percent being accounted for by endowment effects, and with 2.2 percent being accounted for by wage discrimination. Thus, we estimated the discrimination component a bit smaller than Diekmann et al. (1993) did who found 3.9 percent. In contrast, they obtained a value of 5.0 percent for the endowment effect, which is less than half the value we came up with. We believe that the difference in the results is mainly due to the different estimation methodology employed and the different quality of the data used.

Compared to the findings contained in the American and British literature on wage discrimination against minority groups, our estimates for total foreigners versus

Germans can hardly be interpreted as serious discrimination. However, foreigners themselves are quite a heterogeneous group. Thus, the results for all foreigners together are mainly coined by those nationality groups who are quantitatively most important, particularly Turks, who account for about one-third of all foreigners. This might conceal real discrimination against some quantitatively less-important nationality groups. Therefore, the discrimination issue has to be evaluated separately for each nationality group. Correspondingly, we found strong evidence for discrimination against male workers from East Europe, from the Middle East and from the Far East - all nationality groups with a particularly high percentage of new migrants.

One major issue in the measurement of discrimination is of course accurate control for productivity-related wage differentials. The accurate control of productivity differences, however, is often a problem in itself. This will particularly be the case if the productivity measurement leads to systematic underestimation with respect to one of the two groups compared. In our case we cannot exclude the possibility that some of the human capital variables such as school education and vocational training are qualitatively different for Germans and foreigners. This concerns particularly recently migrated foreigners who have acquired their education in their home country. The language as another human capital factor could not be considered in our estimation, either. We partly control for these effects by using the assimilation variable "years since migration", but there may still be some measurement error remaining. We still think that our results are not affected too much by this aspect in terms of quality. Nevertheless, we would have liked to have used panel information in order to better evaluate this aspect, as panel data may be used to control for some individual- or group-specific effects (like transferability of skills and language). It was not possible to use this approach with our dataset, however, thus forcing us to leave this for future research.

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