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Harriet Taylor Mill-Institut für Ökonomie und Geschlechterforschung
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Abstract

This paper investigates the wage differentials between employees of German and non-German nationality, using linked employer-employee data (LIAB) from 1996 to 2007. We estimate establishment-specific nationality wage gaps which allow us to consider the differences in wage setting processes across organisations. Our results show that the absolute pay gap within establishments (10.6 percent on average) is about 5 percentage points smaller than the pay gap in the labour market as a whole, which may indicate a sorting of non-German workers into low-paying establishments. The observed wage differentials are for the most part (8.6 percentage points) explained by differences in education and work experience. Furthermore, we can show that the remainder of the estimated wage gap differs by nationality group. The residual wage gap for immigrants from Eastern Europe and Asia is larger on average than it is for immigrants from South-European "guest worker countries". A regression analysis of selected characteristics on the residual intra-establishment pay gaps reveals that non-German employees face significantly lower wage discrepancies in organisations with a higher share of exports in sales, a higher share of non-German employees and in those covered by collective bargaining agreements.

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1 Introduction

Immigrants make up a sizable portion of Germany's labour force. In 2010, about nine percent of the population possessed foreign citizenship, while another eleven per cent are first or second generation immigrants who have adopted German citizenship (Statistisches Bundesamt 2011a, 33). Given the actual labour shortage, further immigration is one option to fill this gap. However, potentially unfavourable labour market conditions of non-German employees may limit interest in moving to Germany.

It is well documented that non-German workers face clear disadvantages when compared to German natives with respect to employment rates, job prospects and wages (Bender and Seifert 2000, Granato 2003, Kalter 2005 and Dustmann 2010). The most common explanations for this observation are differences with respect to the education level, work experience and language skills (see Diekmann et al. 1993, Licht and Steiner 1994, Bauer and Zimmermann 1995, Lang 2005, Constant and Zimmermann 2009). Remaining wage gaps are further reduced by controlling for individuals' occupations and occupational attainment (Constant and Massey 2003). Hirsch and Jahn (2012), for instance, report an average wage gap between Germans and non-Germans of about 20 per cent which diminishes to between 2.9 and 5.9 per cent if observable differences are taken into account. Velling (1995) as well as Lehmer and Ludsteck (2011) reveal a substantial variation of unexplained wage cuts for non-Germans by country of origin. Employees from the so called "guest worker countries" face a much lower residual wage discount than employees from Eastern Europe, the Middle East or Far East, while employees from Western Europe and other well-developed countries earn the same or even more than Germans.

These remaining wage gaps are addressed by a number of theories which explain why employers might discriminate between immigrants and natives independent of their human capital characteristics. Furthermore, there is a growing body of literature analysing the effects of organisational structure, operational sequences and decision processes on the distribution of wages within firms. Baron (1984), Acker (1990) and Groshen (1991) first promoted the idea that organizations play an important role in creating and maintaining wage inequality. The assignments of job positions and tasks and in some cases also wage negotiations take place at the establishment-level and is hence crucial for the professional advancement of each individual. The outcome of these processes depends upon institutional frameworks, such as the existence of collective bargaining agreements and employee co-determination. Furthermore, the intra-establishment wage distribution seems to be shaped by establishment- or firm-level determinants,

such as size, export-activity and exposure to competitive pressure. While there is evidence that selected firm characteristics affect wage levels as well as overall wage distributions (see e.g. Davis and Haltiwanger 1991; Bronars and Famulari 1997; Abowd, Kramarz and Margolis 1999; Addison, Teixeira and Zwick 2006), the relation of ethnic wage inequality and a company's organisational structure as an origin of this inequality has so far received little attention.[1] One exception is the study by Carrington and Troske (1998), which shows that the distribution of black and white workers across American firms is not segregated systematically when individuals' education is taken into account.

This paper aims at filling this gap and elucidating the establishment-level determinants of wage inequality between German and non-German employees in the German labour market. In order to consider both individual and organisational characteristics as explanatory factors, we follow the methodological approach of Heinze and Wolf (2010), who analyse the gender wage gap within German establishments. The empirical analysis is based on the German LIAB data, a representative linked employer-employee panel. As we are not able to identify an employee's migration background in this data, we distinguish groups by their nationality.[2]

As a first step we investigate the wage differentials between German employees and three groups of non-German employees: (1) all employees with foreign nationality, as well as the subgroups of (2) those from the south European "guest worker countries" and (3) those from Eastern Europe and Asia. We apply Oaxaca-Blinder decompositions to disentangle observed wage differentials into that part which can be explained by employees' human capital endowments, and an unexplained residual. The returns to human capital are estimated in wage regressions, covering i) all employees on the labour market and then ii) in separate regressions for all employees of the respective establishment. This allows us to compare the overall labour market wage gap with average establishment wage gaps. These two measures of wage inequality differ if non-German workers are not distributed randomly across establishments, e.g. if non-German employees are more likely to work in low-wage organisations.

[1] In contrast to this, the institutional effects on the firms' gender wage gaps have been considered e.g. by Blau and Kahn 1995, 1999, 2003; Meng and Meurs 2004; Elvira and Saporta 2001. On the empirical impact of competitive pressure on the earnings of men and women see Black and Brainerd (2004), Oostendorp (2009), Black and Strahan (2001) as well as Heinze und Wolf (2010).

[2] The term immigrant usually refers to persons who migrated themselves or have parents who migrated (migration background). In most empirical studies information on migration background or ethnicity is not available and individuals' citizenship is reported instead. The analysis by Aldashev et al. (2007) suggests, that using citizenship as a proxy for ethnicity may, if any, lead to an underestimation of wage discrepancies between immigrants and natives.

In a second step, we test hypotheses about the link between the intra-establishment wage gap and the establishment's exposure to competitive pressure, the presence of employee co-determination and collective bargaining, respectively. Given the rich information on establishments available in the LIAB data, we consider the effect of selected establishment-specific attributes, such as size, average wage level, proportion of non-German employees and qualification level.

The remainder of the paper is organized as follows: Section 2 discusses the theoretical background of our empirical analysis. The econometric method is expounded in Section 3. Section 4 describes our data sources and sampling procedure. Empirical results are presented in Section 5, and Section 6 concludes.

2 Theoretical background

There are various explanations discussed in the literature for why wages may differ between immigrants and natives. First of all, wage inequality may be caused by differences in their respective productivities, which in turn are supposed to be related to human capital endowments. According to Becker (1964) individuals' labour productivity, and correspondingly their wages, vary as a consequence of differing investments into education. A lower human capital endowment among immigrants may result from a lower level of education in their home countries, or from adverse selection of those who decide to migrate. Additionally, non-transferability of human capital attained abroad can be a reason for (initial) disadvantages among immigrants in the labour market (Chiswick 1978).

2.1 Discrimination theories

Differences in the returns to equal productivities may be ascribed (partly or fully) to discrimination (Arrow 1973).[3] There are essentially three theoretical approaches to explain discrimination, appearing as non-employment, segregation or direct wage discrimination in the labour market: (i) preferences for discrimination, (ii) statistical discrimination and (iii) monopsony power or overcrowding. According to Becker (1957), wage discrimination arises from the employers' (or employees' or customers') preferences for members of one group

[3] Theories of segmented labour markets provide an alternative explanation for differences in the remuneration of natives and immigrants (see Doeringer and Piore 1971, Piore 1980).

over those of another despite equal labour productivities. Discriminating employers act as if hiring foreign workers will not only impose wage costs but also an additional disutility to the firm. As a result, Becker's discrimination theory assumes costs for discriminating firms, since they will hire fewer than the profit maximizing number of immigrant workers, and correspondingly employ too many natives with a higher pay. Statistical discrimination refers to underestimation of immigrant workers' productivity by employers in case of a lower average productivity of this group compared to natives when incomplete information is assumed (Phelps 1972, Arrow 1973). Furthermore, the models of overcrowding and monopsony power attribute discrimination to segmented labour markets. The theory of overcrowding explains lower wages of foreign employees by excess supply of labour in segments or occupations which are predominantly chosen by or assigned to non-natives (Edgeworth 1922). Bergmann (1974) refined this theory, suggesting that firms are able to raise profits by enforcing occupational segregation. According to monopsony theory, employers with monopsony power can maximize profits by differentiating wages between groups with unequal labour supply elasticity (Robinson 1933, Cain 1986). Therefore, wage discrimination may arise if the labour supply of immigrants is less elastic than that of natives at the firm level.

2.2 The impact of firm characteristics

We draw on Becker's discrimination theory to derive hypotheses about the link between firm characteristics and within-firm wage inequality. Since (taste) discrimination theoretically results in a suboptimal allocation of resources, it has been argued that the likelihood of discrimination is reduced under conditions of strong *market competition* (see Arrow 1973, Cain 1986). Assuming larger firms to have more market power than smaller firms, this hypothesis can be tested by the correlation between firm size and residual wage inequality. Furthermore, the relation of firm size to sector size is used to test the impact of market power. Firms operating on the world market may be subject to higher competitive pressure than firms operating only nationally or locally. Therefore, firms with a higher export quota are expected to act in a less discriminatory manner because they are more often subject to cost pressure. However, it can be argued that large and globally acting firms may have a higher demand for workers with knowledge of foreign languages and cultures and therefore might be less inclined to discriminate against foreigners and pay them higher wages.

In accordance with Becker's discrimination model, the *share of non-German employees* might provide information about employers' tastes. However, a relation between the share of non-German employees and wage inequality can

not be inferred, since exclusion of these workers is only one possible outcome of discrimination. Prejudiced employers would theoretically be indifferent to not hiring non-Germans or hiring them at reduced wages (or in lower status positions). Therefore, the connection of the share of foreign employees in the firm to the residual wage gap is not explicit.

One of the most important factors of wage determination within firms is whether or not wages are subject to *collective bargaining* (Elvira and Saporta 2001). This is particularly true for Germany, where unions still play an important role in the wage setting process. While the overall impact of unions on wage differentials is not obvious, collective bargaining models provide several reasons for arguing that collective agreements tend to reduce the wage gaps between employees within establishments. First of all, unions generally reduce the wage dispersion among employees covered by the same collective bargaining agreement, especially those working in the same occupation (Freeman and Medoff 1984, Fitzenberger and Kohn 2005). As a consequence, unionization should reduce the wage discrepancy for foreigners performing the same activity as German colleagues within the same firm. Cornfield (1987) points out that in the case of layoffs, bureaucratic rules consequently reduce the potential for discrimination. Elvira and Saporta (2001) apply the same logic to the wage setting process. They argue that collective wage agreements reduce the arbitrariness of wage rates and therefore reduce wage discrimination.

Furthermore, *work councils* may also affect wage distribution within firms (Hübler and Jirjahn 2003, Addison, Teixeira and Zwick 2006). Note that work councils cannot directly engage in wage bargaining, but may influence the firm's wage structure by the right of co-determination in the allocation of workers to different wage groups. They are also involved in decision-making in the introduction of pay systems, such as performance-related pay schemes, and the setting of wages above agreed tariff and bonus rates. According to Baron (1984), work councils often act as equalizing agents by monitoring compliance with corporate or legal principals aimed at achieving equal opportunities and avoiding discrimination. As a result, the existence of a work council should counteract wage inequality within firms.

3 Data and description of the sample

The impact of an organisation's characteristics and institutional framework on internal wage inequality can only be evaluated with data including linked information on employers and employees. For this reason, we choose the

combined employer-employee data set, LIAB, in which the IAB-establishment panel and the IAB employment statistic of the German Federal Services are merged based on a unique firm identification number.

The IAB-establishment panel is an annual survey of German establishments which started in West Germany in 1993, and was extended to East Germany in 1996 (Kölling 2000). The sample of selected establishments is random and stratified by industry, firm size class and region. The sample unit is the establishment which is officially defined as the firm's head office or a local branch office of a firm with several headquarters.[4] The surveyed establishments are selected from the register of all German establishments that employ at least one employee covered by social security. The LIAB dataset is thus a representative sample of German establishments employing at least one employee eligible for social security. The establishments covered by the survey are interviewed annually on employment trends, business strategies, investments, wage policies, industrial relations and varying special topics such as perceived personnel problems, hours of work and vocational training.

The IAB employment statistic of the German Federal Services, the so-called Employment Statistics Register, is an administrative panel dataset of all employees paying social security contributions in Germany (see Bender et al. 2000). These data cover all persons who were employed for at least one day since 1975. Social security contributions are mandatory for all employees who earn more than a lower earnings limit. Civil servants, self-employed and people with marginal jobs, that is, employees whose earnings are below the lower earnings limit or temporary jobs which last 50 working days at most, are not covered by this sample. Altogether, the Employment Statistics Register comprises about 80 percent of all West German employees. According to the statutory provisions, employers are obliged to report information for all employed contributors at the beginning and end of their employment periods. In addition an annual report for every employee is compulsory at the end of each year. This report contains information on the employee's occupation, the occupational status, qualification, sex, age, nationality, industry and the size of the establishment. The available information on daily gross earnings also refers to employment spells that employers report to the Federal Employment Service. If the wage rate exceeds the upper earnings limit ("Beitragsbemessungsgrenze"), the daily social security threshold is reported instead. Note that the daily wage rate is therefore censored from above and

[4] To support ease of reading, we use the terms firm and establishment synonymously in the following.

truncated from below. Both data sets contain a unique firm identifier which is used to match information on all employees paying social security contributions with the respective establishment in the IAB-establishment panel.

For the purpose of our analysis, we exclude establishments which employ fewer than 10 full-time employed Germans and non-Germans respectively who are subject to social security contributions, because the calculation of a firm-specific wage gap is not statistically robust in those cases. This step leads to the exclusion of a great number of mostly small establishments. Furthermore, we restrict our sample to West German establishments[5] of the private sector who participated in the IAB-establishment panel in at least one year from 1996 to 2007. In contrast to the private sector, pay systems in the public sector are highly centralized and regulated by the Federal Act on the Remuneration of Civil Servants ("Bundesbesoldungsgesetz"). This bill requires equal pay for all individuals with the same seniority and qualification who work in a specific job. As a result, the wage gap in the public sector should be significantly lower than that of private firms (see e.g. Melly 2005). A description of the firm sample is provided in the appendix.

Due to the lack of explicit information on working hours, we consider only full-time employees. We also exclude employees under the age of 20 and over the age of 60 in order to eliminate the particularities of early retirement and transition from school to work. Since migration background is not captured in the data, employees are distinguished by their nationality. This entails that immigrants who were naturalized before 1996, the first year in the period under review, cannot be identified as such. Foreign employees whose citizenship changed to German in the observation period are consistently regarded as non-Germans in the wage comparisons, in order to consider migration background wherever possible[6]. The share of foreigners among employees eligible for social security in Germany amounts to about seven percent in the years under consideration (Statistisches Bundesamt 2011b, 92).

There is great variation among non-native employees in Germany with regard to education, work experience, social integration and potential subjection to

[5] Eastern German establishments are not considered in the analysis because both the wage levels as well as the wage setting processes are still very different from those in West Germany. A separate analysis for Eastern Germany is not possible, due to the small percentage of non-German employees (less than 1%) such that the number of firms with the required number of non-German employees – at least 10 – is too small to derive reliable results.

[6] Employees who changed their nationality from German to non-German were also considered as German. Changes of nationality were observed for up to 1% of the sample. Employees with more than one nationality change were excluded from the sample.

discrimination (Woellert et al. 2009). Thus we analyse the wage gaps between German employees and different groups of non-German employees. One group of interest are employees from the so called "guest worker countries" who came to Germany in the 1960's and 70's in the course of recruitment agreements between Germany, and Italy, Spain, Greece, Turkey, Portugal and former Yugoslavia, respectively. The programme was introduced because of a shortage of low skilled workers in the German industrial sector. As many families that came to Germany during that period may now have adopted German citizenship, information on migration background would be helpful to analyse this group. The major portion of this group is represented by migrants from Turkey. Second, we calculate the wage gap between Germans and employees from Eastern Europe and Asia. The number of immigrants from these countries has been rising over the last decade (Federal Employment Service Statistics 2010). Velling (1995) showed that immigrants from these regions face relatively high residual wage gaps in Germany, which suggests that they face discrimination in the labour market.[7] Because of the minimum requirement of 10 employees from each group, the number of firms is smaller for the analysis of the sub groups of foreign employees.

Table 1 shows the characteristics of German and non-German employees that are included in the wage regressions below. Compared to Germans, a clearly higher share of non-German employees has no (acknowledged) occupational degree. The share of employees with high school graduation or a university degree is markedly lower in the group of guest workers, but highest among employees from Eastern Europe and Asia.[8]

[7] Employees from EU-15 countries (apart from the guestworker countries), Switzerland and USA are not analysed separately because wage discrimination is assumed to be of minor importance for them. The sample numbers of employees from South America and Africa are too small for separate analyses at the firm-level.

[8] A table depicting sector attachment by nationality and sector wage-levels is provided in the appendix.

Table 1: Average human capital endowments by nationality group

1996-2007	German employees	All non-German employees	Employees from guest worker countries	Employees from Eastern Europe and Asia
No occupational degree (%)	12.81	48.61	56.84	32.83
Vocational training (%)	66.25	41.42	39.28	42.79
High school graduation (German Abitur) (%)	6.86	3.51	1.92	7.98
University degree (%)	14.08	6.46	1.96	16.39
Potential work experience (in years)	23.41	23.56	23.20	21.67
Tenure in firm (in years)	11.38	10.80	11.18	7.04
Employee Observations	9,782,478	1,099,824	786,989	102,872

Source: LIAB 1996-2007, own calculation

4 Econometric approach

As laid out in Section 2, employees' wage rates are assumed to be affected by both individual and firm characteristics. It is the aim of this article to examine whether the observed wage discrepancy for non-citizens in Germany varies across companies, and which firm characteristics may explain this variance. In other words, wage determinants on the firm level are hypothesized to have an impact on the wage effect of possessing a foreign nationality. These types of questions can be addressed by multilevel models with "varying slopes" (Cardoso 1997). These, however, deploy the rather strong assumption that unobserved wage effects are distributed randomly across firms. We therefore apply a two-step procedure which, in its general form, has been applied frequently in the context of wage differentials between firms (see Kramarz, Lovelier and Pelé 1996, Leonard, Van Auenrode 1996, Leonard, Mulkay, Van Auenrode 1999). This means that first wage inequality by nationality is estimated separately within each (large) firm. In the second step, these estimated wage gaps are regressed on selected firm characteristics. Compared to a single equation multi-level model, this method is more flexible in the sense that the heterogeneity of wage setting processes between firms is fully taken into account. Estimates of the returns to individual characteristics result from the respective within-firm variances. However, for the same reason it is potentially less efficient.

4.1 Labour market wage differential

We apply the method of Oaxaca (1973) and Blinder (1973) to decompose observed wage differentials by nationality in the aggregate level of the labour market as well as within firms into that part which can be explained by human capital endowments and a residual or unexplained part. The observed wage gap is defined by the difference of mean log earnings of German and non-German employees.[9]

(1) $$Gap^{obs} = \overline{\ln w^{ger}} - \overline{\ln w^{for}}$$

Since the wage information in our data set is right-censored (see Section 3 for more details), the wage gap in equation (1) underestimates the actual wage differential. We correct for this censoring by applying a Tobit model when estimating wage regressions with a dummy for German nationality (N_i) as the only explanatory variable (for each year 1996-2007). Thus, the observed wage gap in a given year is defined by γ in the following equation.

(2a) $$\ln w_i = \alpha + \gamma N_i + \mu_i$$

Estimated as a pooled model with time dummies and interactions this becomes

(2b) $$\ln w_{it} = \alpha + \sum_{t=1}^{T} \lambda_t T_{it} + \gamma N_i + \sum_{t=1}^{T} \delta (N_i \cdot T_{it}) + \mu_{it}$$

In order to decompose the wage gap into a part caused by differences in human capital endowment and a part caused by differing remunerations to human capital by nationality, these remunerations need to be estimated. As it turns out, it is sufficient to estimate only the remunerations for one of the two groups. We use a standard Mincer equation, including dummy variables for the education level, employees' potential experience (squared)[10], job tenure and employees' sex (X_{it}^{ger}). Additionally, time dummies are included in the model.

(3) $$\ln w_{it}^{ger} = \alpha + \beta^{ger} X_{it}^{ger} + \sum_{t=1}^{T} \lambda_t T_{it} + \varepsilon_{it}^{ger}$$

[9] The method is exemplified for the wage gaps between German and Non-German employees. It is applied in the same way to calculate the wage gaps between Germans and employees from "Guest Worker" countries as well as employees from Eastern Europe and Asia.

[10] Potential experience of an individual is calculated as age minus years of education minus 6 years pre-school. The data used do not provide information on the extent to which experience was attained abroad or in Germany. It is thus assumed that experience attained abroad is transferable to the German labour market.

Oaxaca-Blinder decomposition is attained by

$$Gap_t^{unexp} = Gap_t^{obs} - \hat{\beta}^{ger}(\overline{X_{it}^{ger}} - \overline{X_{it}^{for}}) \quad (4)$$

Unfortunately, language skills and the degree of integration/assimilation are not observed in the data. Therefore it must be kept in mind that the residual pay gap cannot unambiguously be interpreted as discrimination, but may also be influenced by these unobserved factors.[11] Estimation of a panel model is not possible, since we are interested in the coefficients of the time invariant educational degrees. Thus, wage regressions are pooled over time and standard errors are adjusted, taking into account that observations of individuals in different years are not independent. The right-censoring of the dependent variable again requires the estimation of a Tobit model. The resulting remuneration vector is not allowed to vary over time.

4.2 Intra-firm wage differentials

The intra-firm observed wage gaps are obtained by use of equation (2b) within each firm. Firm-specific remunerations to human capital are estimated analogous to equation (3) for each large firm (with a minimum of 100 German and 10 non-German employees). To exploit the information on smaller firms, we run a joint regression for establishments with 10 to 99 German employees and at least 10 non-German employees. Given the firm-specific observed wage gaps (Gap_{jt}^{obs}) and the results on firm-specific returns to human capital, we can calculate the residual wage gap where X_{ijt} includes mean characteristics of the individuals (at firm j in year t) and $ß_j^{ger}$ are vectors of estimated coefficients for each large firm, respectively one vector for all small firms.

$$Gap_{jt}^{unexp} = Gap_{jt}^{obs} - \hat{\beta}_j^{ger}(\overline{X_{ijt}^{ger}} - \overline{X_{ijt}^{for}}) \quad (5)$$

4.3 Firm-level determinants of residual wage gaps

Using the residual firm-specific wage differential as a dependent variable allows us to analyse the relationship between firm characteristics and intra-firm wage inequality. The wage gap, which is adjusted for the difference in human capital

[11] Additionally, part of the observed differences may be caused by inequality with respect to access and encouragement to education. Furthermore, there might be a discriminating element in the selection of employees, such that observed characteristics of employees as well as estimated coefficients are not distributed randomly across firms. In order to correct for this selection, we would have to estimate employment probabilities (Datta Gupta, 1993). Due to the lack of information on the *household* context and individual background, it is difficult to implement this procedure which requires convincing exclusion restrictions.

characteristics (Gap_{jt}^{unexp}), is assumed to depend on the explanatory variables derived in Section 2. Firms' exposure to competitive pressure (C_{jt}) is captured by firm size, firm size relative to sector size and export quota. The institutional framework (I_{jt}) is accommodated by dummy variables on the existence of a collective wage agreement and a work council. Apart from these variables, we control for the average wage level within the firm, proportions of female employees, non-German and qualified employees, region, industry sector and year (Z_{jt}).

Firms' discriminatory preferences are essentially unobserved, and are likely to be correlated with the explanatory variables in the model.[12] One possibility to mitigate potentially resulting bias is to control whether a firm is in foreign ownership, since this is likely to coincide with lower or even reversed discriminatory preferences. However, this would restrict the sample to the years 2000 to 2007. Under the assumption that preferences of a firms' management are relatively stable across time, the problem can be approached by estimating a model with fixed firm effects. Hence, all unobserved time-invariant heterogeneity on the firm-level is controlled for and the coefficients of the variables of interest are thus more likely to reflect causal relations.

(6) $$Gap_{jt}^{unexp} = \alpha_j + \beta C_{jt} + \rho I_{jt} + \delta Z_{jt} + \varepsilon_{jt}$$

4.4 Labour market and intra-firm wage estimations

Wage estimation at the level of the labour market (without considering the heterogeneity of firms) yields the expected results: employees with higher educational degrees and more experience receive higher wages, while the marginal returns to experience are diminishing.

The within-firm wage regression results for German employees are shown in Table 2. The averages of the coefficient estimates display positive returns to the indicators of human capital. However, it becomes obvious that there is substantial variation in these returns among firms. Firms seem to differ particularly in their remuneration to firm-specific human capital measured by tenure. Compared to small firms, large firms are characterized by a higher average wage level (constant) and partially lower returns to individual characteristics. As indicated by the coefficient estimates for the female employee

[12] A Hausmann-Test confirms correlation of unobserved heterogeneity and the covariates. There are significant differences between the coefficients of a random effects and fixed effects model. Thus, a random effects model is not applicable as it would yield inconsistent estimators.

dummy, the gender wage gap among German employees is greater within small firms (about 23 percent) than within large firms (about 13 percent). All within-firm coefficients for large firms are for the most part significantly different from zero at the five percent level. All coefficients are highly significant in the pooled regression for small firms.

Table 2: Estimation results of intra-firm wage regressions for German employees

	Large firms				Small firms	
	Mean of coeff. estimates	**Mean of t-values**	**Share of coeff. at 5%-significance level**	**Variation coefficient (std.dev/ mean)**	**Coeff. estimate**	**t-value**
Potential Experience	0.0229	7.50	0.85	0.5813	0.0261	38.32
Potential Experience²	-0.0004	-5.60	0.77	-0.6648	-0.0004	-30.37
Job tenure (in years)	0.0149	4.88	0.76	2.0735	0.0134	46.76
Low education without vocational training	-0.6445	-22.22	0.96	-0.4844	-0.2699	-69.93
Vocational training	-0.4785	-19.12	0.95	-0.5684	Reference	
Secondary schooling (Abitur)	-0.2871	-13.75	0.82	-1.0138	0.1906	19.68
College/university degree	Reference				0.5147	56.11
Female employee	-0.1332	-6.03	0.82	-0.7604	-0.2341	-58.85
Constant	4.7346	124.52		0.0708	4.0332	513.39
Establishment Observations	12,469				2,082	
Employee Observations	10,774,829				107,473	

Note: Dummy variables for different years are included in the estimation.
Source: LIAB 1996-2007, own calculation

4.5 Decomposition of the labour market and the intra-firm wage gaps

The overall disparity between the labour market wages of German and non-German employees amounts to about 15.5 per cent in the years 1996 to 2007 while the trend is slightly decreasing. [13] Controlling for the human capital endowments of both groups leaves a residual wage gap of about 3 per cent in the given period (see Figure 1).

Within German establishments, the observed wage gap amounts to 10.6% on average. Our Oaxaca-Blinder decomposition reveals that this wage gap is mainly caused by differences in education and work experience between these two

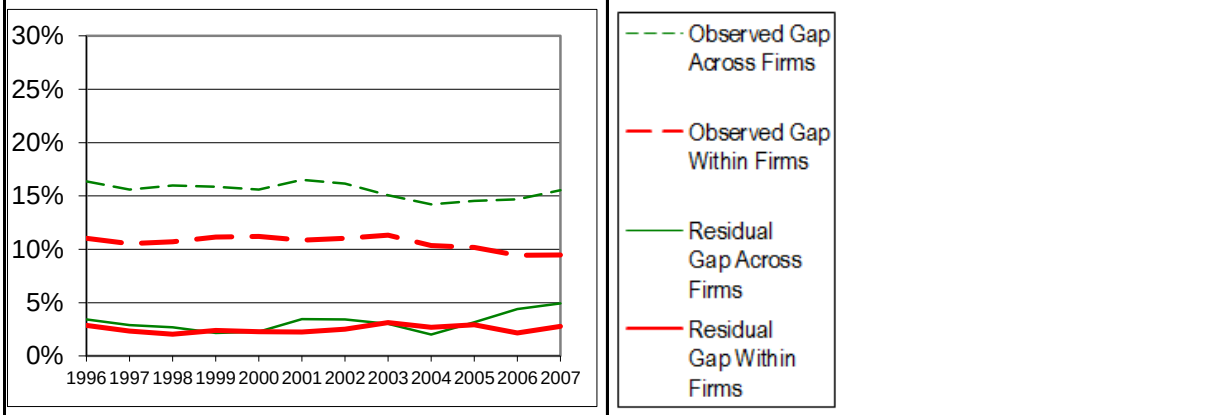
[13] Estimation of the labour market wage gap with an extended sample, including also small establishments with fewer than the required 20 employees, reveals an even smaller average gap. Another extension with East German establishments does not yield robust results due to the low percentage of non-German employees.

groups of employees (8.1 percentage points). The remaining 2.5 percentage points of wage difference are left unexplained.[14] Given the basic specification of our wage regressions this result appears somewhat smaller than in other empirical studies, but confirms the overall finding of modest unexplained immigrant-native wage gaps in Germany (Diekmann 1993, Velling 1995, Licht and Steiner 1995, Lang 2005, Lehmer and Ludsteck 2011, Hirsch and Jahn 2012). While the observed pay gap within firms decreases slightly over the years under review, from 11.0% in 1996 to 9.5% in 2007 (see figure 1), the residual pay gap remains rather stable. This implies that the differences in education and work experience between the two groups became smaller, whereas differences in the remuneration of these human capital variables remained unchanged.

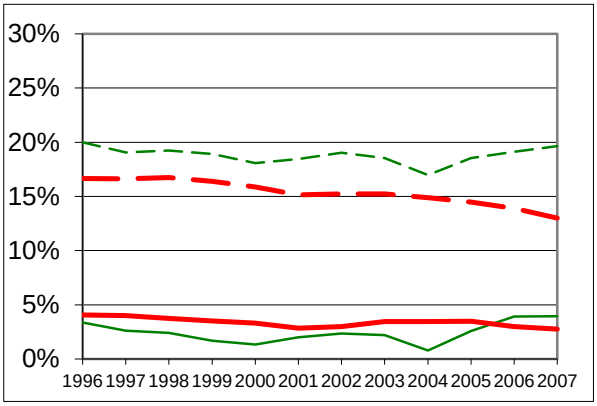
[14] The additional inclusion of the variable "job position" as an indicator of the employee's occupational status reduces the residual wage differentials by about 2 percentage points. Job position is represented by the categories "unqualified worker", "qualified worker", "foreman" and "clerk".

Figure 1: Development of wage gaps between German and non-German employees

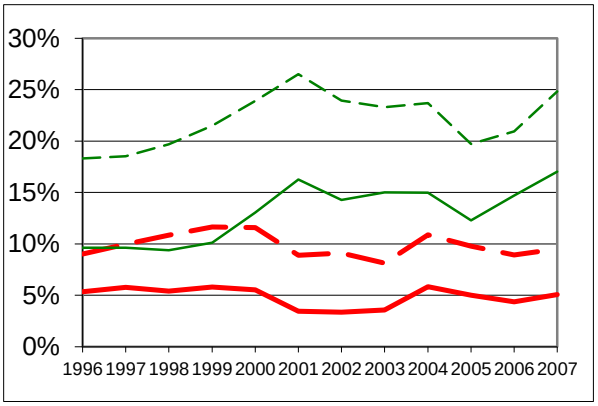
All non-German employees
Establishment Observations=14.551



Employees from "guest worker" countries
Establishment Observations=10.923



Employees from Eastern Europe, Asia
Establishment Observations=3.804



Source: Own calculations based on the LIAB crosssectional version 1996-2007.

Figure 1 also illustrates the difference between the average within-firm wage gap and the wage gap that results when a homogeneous remuneration structure is assumed in the labour market. The clear disparity of about 5 percentage points between those measures suggests that there is a selection of non-German workers into low-wage-firms. This becomes comprehensible when one assumes that there are "high wage firms" and "low wage firms" which both exhibit small wage gaps by nationality. In this case, a large pay gap on the labour market results from few foreign employees in "high-wage" firms, and many foreign employees in "low-wage" firms. A selection of foreign workers into lower paying firms is plausible given their lower average level of education. In fact, there is no substantial disparity between the two methods of calculation once we control for differences in human capital.

The distribution of the residual wage gap across firms (see Figure 2) is less dispersed than the distribution of the observed pay gap because a significant part of the variance in wages has been controlled for. While a quarter of the firms pay non-German employees at least 7% lower wages than Germans, despite equal qualifications, a quarter of the firms also remunerate foreign employees better than Germans.

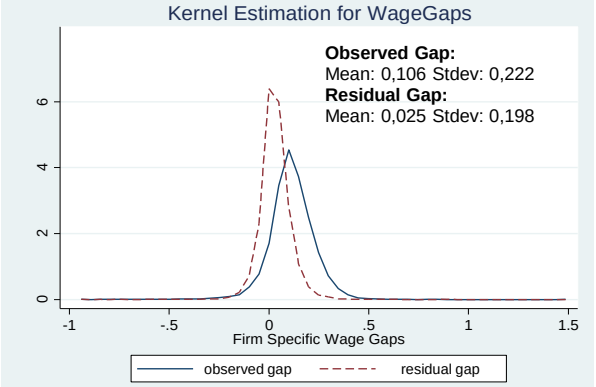
Looking at the aggregate wages of all non-German employees compared to German employees may conceal specific disadvantages for certain nationalities. Velling (1995) as well as Ludsteck and Lehmer (2011) showed that the wage differentials vary considerably by nationality. Our approach of calculating intra-firm wage differentials requires a minimum number of employees for each nationality group within each firm, and hence makes it difficult to calculate nationality-specific wage gaps. Nevertheless, results for two subgroups, which are supposed to be more or less homogenous, are presented in the following. The total wage gap between employees from "guest worker" countries (Italy, Greece, Turkey, Portugal and former Yugoslavia) and German employees within establishments is higher (15.3%) than the wage gap between all non-German and German employees (see figure 1). This result is to some extent driven by the relatively low level of average education in this group (see table 1). The residual pay gap for guest workers within firms is slightly higher than it is for foreigners overall (3.4%). As was true for all non-German employees, there is a clear disparity between the observed wage gap on the labour market level and the average within-firm wage gap, but there is no such effect of considerable size when human capital endowments are controlled for. The distribution of wage gaps across firms also appears to be quite similar to the result for non-German employees overall.

The observed intra-firm pay gap for East European and Asian employees is much smaller than for employees from "guest worker" countries (average 9,9%), which is consistent with the high average level of education in this group (see figure 1). Nevertheless, they face a relatively high residual wage gap of 4.9 percent on average. The employment of workers from Eastern Europe, in particular, as well as that of employees from Asia has been increasing in Germany in the last decade. Therefore, the residual wage gap may reflect initial language or cultural barriers, but may also be due to more pronounced discrimination against these nationalities. It is striking that for employees from Eastern Europe and Asia, the total as well as the residual wage gap is higher on the labour market level than on average within firms. This indicates a selection process into lower paying firms that cannot be ascribed to differences in human capital endowment. This effect becomes even more noticeable in the most recent years. Thus, it seems

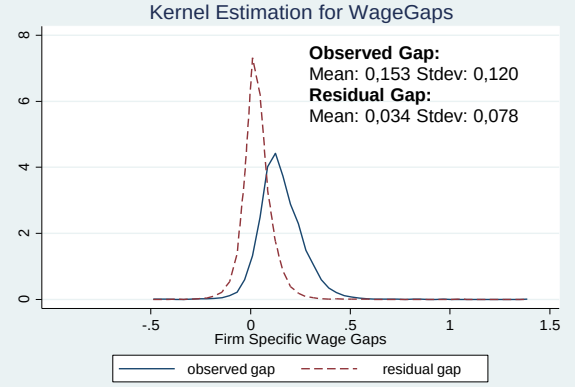
plausible to presume that selection of newly arriving immigrant workers into low-paying firms (with relatively low intra-firm inequality) contributes considerably to overall wage inequality between employees from Germany and Eastern Europe and Asia. Furthermore, for this group, there is a relatively small difference between the distribution of the observed wage gap and the residual wage gap across firms. This reflects that, compared to employees from guest worker countries, human capital variables explain a smaller fraction of the wage inequality between employees from Germany and Eastern Europe and Asia. Another explanatory factor might be the missing formal approval of education degrees not acquired in Germany – a problem particularly faced by migrants from Eastern Europe (Brussig et al. 2009). However, it has to be kept in mind, that the number of firms used for analysing this group of nationalities is small.

Figure 2: Distribution of within-firm wage gaps between German and non-German employees

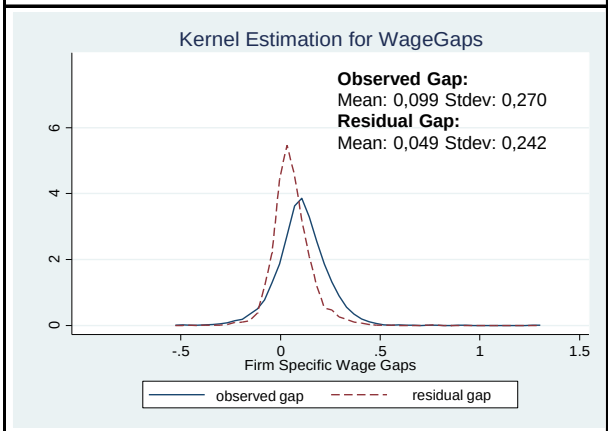
All non-German employees
Eestablishment Observations=14.551



Employees from "guest worker" countries
Establishment Observations=10.923



Employees from Eastern Europe, Asia
Establishment Observations=3.804



Source: Own calculations based on the LIAB 1996-2007.

4.6 Analysis of firm heterogeneity

In the third part of our empirical analysis, we investigate the interdependencies of firm characteristics and the institutional framework with the firm-specific wage differentials between German and non-German employees. We take the residual wage gaps within firms as the dependant variable, and estimate its relation to selected firm-level variables. In order to exploit the panel structure of our data, we run fixed-effects estimations. Thus, we can answer the question of whether a change in a firm-level variable over time is related to an increase or decrease in the unexplained nationality wage gap. The impact of the respective variable in limiting or allowing discretion in wage policies can therefore be estimated, while time invariant (discriminatory) preferences of decision makers in the firm are controlled for.

We use firm size, firm size relative to sector size, and export quota to test whether firms with market power have more discretion to deviate from market wages, and therefore reveal a higher residual wage gap. The impact of the institutional framework on the wage gap is investigated by including a dummy variable for the existence of a work council. To test the hypothesis that collective wage agreements lead to less wage inequality between German and non-German employees, we distinguish establishments that are bound to industry-wide or firm-specific wage agreements from those that are not subject to collective wage agreements. To investigate whether firms that employ more foreign employees also behave in a more egalitarian manner with respect to wages, the share of non-German employees in the establishment is included. The average wage bill per employee is added in order to control for differences between high and low wage firms. Furthermore, the share of non-German employees, female employees and qualified employees in the workforce are included in the model. The number of different establishments accounted for in the estimations is 2,748 for the analysis of Germans and all non-German employees, 2,055 for wage differentials between Germans and guest workers, and 605 for employees from Eastern Europe and Asia compared to German employees. Summary statistics of the selected firm variables are presented in the appendix. The estimation results are presented in Table 3.

It is well known from previous studies that large firms pay higher wages than small firms, irrespective of the skill composition of the workforce (e.g. Davis, Haltiwanger 1991, Bronars, Famulari 1997, Kramarz, Lollivier, Pelé 1996). But is this effect pronounced differently across ethnic groups? An increase of the firm-size is significantly related to higher wage discrepancies for non-German employees. This result is in line with the hypothesis of more pronounced

discrimination in firms with more market power. Apart from direct wage discrimination, this result could also stem from segregation. If wage dispersion increases with firm size and non-German employees are confined to low positions, firm growth leads to larger wage gaps. However, there is no significant effect of firm size on the wage gap of employees from Eastern Europe and Asia while the group of employees from guest worker countries rather benefits from firm growth relative to German employees (i.e. the overall positive link is mainly driven by French, UK, Us and Scandinavian origins). This may be linked to the finding that wages of employees in low positions are highly affected by firm structures, while the rewards to individual characteristics are low (Davis, Haltiwanger 1991). Neither a change in the ratio of firm size and the respective sector size nor a firms' export quota is significantly related to the wage gaps examined. Thus, overall, it is not confirmed that an increase of market power affects a firm's wage policies with respect to wage inequality between German and non-German employees. However, it may be the case that changes in a firm's market situation have an impact in the long run.

Larger residual wage discrepancies for employees from guest worker countries were found in establishments with a work council. This result is in contrast with the theory that sees work councils as advocates for equal opportunity policies. Additionally, it is not in line with previous studies which showed that the existence of a work council generally helps to compress the wage distribution within firms (Addison, Teixeira, Zwick 2006) and to reduce the gender wage gap (Heinze, Wolf 2010). Though it does not seem plausible that work councils contribute to higher wage inequality between German and non-German employees, median voter theory predicts that they act in favour of the core workforce which is dominated by native employees. An analysis of the interaction effects between work council and group size of the non-German employees seems to support this argument: The impact of the work council on the wage gap decreases with the share of migrant employees.

As the collective bargaining model suggests, firms under collective wage agreements tend to have smaller unexplained pay gaps between German and non-German employees. This also applies to the pay gap between Germans and guest workers. No statistical link was found for the intra-firm wage gap between Germans and employees from East Europe and Asia though, presumably due to the relatively small number of firms that employ a sufficient number of workers from this group.

An increase in the intra-firm wage level goes along with larger wage disparities between nationalities. That is, German employees benefit more from wage

increases (or lose less when wages decrease). This may indicate a kind of glass ceiling effect for non-German employees – a well-known phenomenon from studies on wage inequality between men and women – referring to the idea that, in this case, the wage rate of non-German employees is capped at a certain threshold, partly caused by disadvantages in occupational attainment or promotion opportunities.

An increase in the share of employees from guest worker countries is related to a lower residual wage gap for employees from this group. This means that firms that hired these employees increasingly provide equal wages. The existence of a link between discriminatory preferences and non-employment of foreign workers is supported by this finding. An increase in the share of non-German employees overall is not significantly related to the wage gaps of foreign employees. An increase in the share of qualified workers goes along with higher unexplained wage gaps between employees from Germany and guest worker countries. This means that even after controlling for individual human capital characteristics, employees from this group are disadvantaged in skill-intensive firms. An increase in the proportion of women in the workforce is clearly connected to larger nationality wage gaps.

Table 3: Regression analysis of the within-firm wage differential between German and (groups of) non-German employees (Fixed effects, 1996-2007)

1996 - 2007	**All non-German employees**		**Employees from guest worker countries**		**Employees from Eastern Europe and Asia**	
Variables	Coeff.	Standard Errors	Coeff.	Standard Errors	Coeff.	Standard Errors
Number of employees/1000	0.0407***	0.0100	-0.0149***	0.0027	0.0059	0.0248
(Number of employees/1000)²	-0.0007**	0.0003	0.0003***	0.0001	-0.0001	0.0006
Relative firm size (employees relative to total employment in the industry sector)	-0.1082	0.1891	-0.0126	0.0443	0.0752	0.1142
Export quota (of sales)/10	-0.0013	0.0019	0.0001	0.0005	0.0124*	0.0064
Monthly wage bill per employee/100	0.0010**	0.0004	0.0001	0.0001	0.0021	0.0014
Share of non-German employees	0.1068	0.0772	-0.0612**	0.0243	0.4672	0.4598
Share of females	0.4367***	0.0633	0.1584***	0.0213	0.2153	0.2323
Share of qualified employees	-0.0128	0.0164	0.0093*	0.0049	-0.0099	0.0562
Work council	0.0159	0.0167	0.0138**	0.0058	-0.0016	0.0725
Collective wage agreement	-0.0234**	0.0103	-0.0055*	0.0033	-0.0040	0.0442
Establishment Observations	10,194		7,842		2,456	
Number of Establishments	2,748		2,055		605	
R² (within)	0.0110		0.0235		0.0105	

Note: Dummy variables for the years are also included in the estimation.
*** significant at 1%-level, ** significant at 5%-level, * significant at 10%-level.
Source: LIAB 1996-2007, own calculation

5 Conclusions

This study provides a first analysis of the wage differentials between employees of different nationalities *within* establishments in Germany and compares the results with wage differentials in the labour market as a whole. The variance of the within-firm wage gaps among firms is displayed and selected determinants on the firm-level are considered to explain this variance. The analyses are based on the LIAB panel, which combines information on employers and employees by merging the IAB-establishment panel and the IAB employment statistics of the German Federal Services.

The average *observed* wage gap between German and non-German employees within German establishments decreases slightly over time, from 11.0 percent in 1996 to 9.5 percent in 2007. In contrast to this, the corresponding *observed* wage gap at the aggregate level of the labour market amounts to more than 15 percent in most years. These differences, revealed by the two ways of looking at wage gaps, suggest a sorting of non-German workers into low paying firms. The *observed* intra-firm wage gaps are mainly caused by differences in education and work experience between German and non-German employees (on average 8.1 percentage points). Hence, the *residual* pay gap amounts to about 2.5 percent. However, compared to all non-German employees, guest workers from Southern Europe face larger "explained" wage discrepancies, while for employees from transition countries (Eastern Europe and Asia) a relatively large part of the differential remains unexplained – possibly due to a missing formal approval of their education degrees.

The methodological approach of the study at hand acknowledges that remunerations in the labour market do not only vary by individual characteristics but also between firms. The results confirm that the nationality dimension of wage differentials manifests differently across firms. This applies particularly to the observed wage gap and, to a somewhat lesser extent, to the residual wage gap. From discrimination theory and collective bargaining models it can be inferred that this variance may to some extent be explained by establishments' market situation and institutional framework. We have been able to show that foreign workers face significantly lower wage discrepancies in smaller firms, which supports the hypothesis that firms that are exposed to strong market competition are less likely to act in a discriminatory manner. However, other measures of the exposure to market competition, i.e. firm size compared to sector size and export activity, do not confirm this link. Collective bargaining agreements are clearly related to lower inequality between German and non-German employees within establishments. A rather surprising result is that work

councils, usually regarded as institutions which limit inequality within firms, do not seem to reduce the wage differentials between German and non-German employees. One possible explanation for this may be that the median voter will usually be a native employee. Another interesting result is that high wage firms exhibit larger wage discrepancies for non-German employees. In accordance with the evidence on gender pay gaps, we interpret this finding as a kind of glass ceiling effect, meaning that the wage rates of foreign employees are capped at a certain threshold, partly because of disadvantages in occupational attainments.

Acknowledgement

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Appendix

Table A1: Sector attachment by nationality group

1996-2007	German employees	All non-German employees	Employees from guest worker countries	Employees from Eastern Europe and Asia	Average wage (standard deviation)
Agriculture (%)	2.98	1.94	2.26	1.26	110.92 (28.56)
Manufacturing (%)	67.54	77.08	79.88	61.11	115.27 (29.70)
Construction (%)	0.74	0.85	0.85	0.82	106.61 (28.74)
Trade (%)	3.13	2.44	2.02	4.16	101.54 (34.56)
Finance (%)	8.25	2.10	1.54	3.24	126.33 (27.84)
Gastronomy (%)	0.17	0.56	0.35	1.77	69.49 (25.90)
Health care (%)	7.76	5.31	4.42	13.70	99.71 (29.40)
Other services (%)	9.45	9.72	8.68	13.95	106.12 (32.86)
Employee Observations	9,725,056	1,095,020	783,566	102,537	103.03 (20.81)

Source: LIAB 1997-2006, own calculation

Table A2: Descriptive statistics of firm samples used for heterogeneity analyses

	German – non-German		**German – guest worker**		**German – East European and Asian**	
Variables	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Absolute wage gap	0.1112	0.2145	0.14852	0.1038	0.1064	0.3204
Residual wage gap	0.0259	0.1951	0.0321	0.07407	0.0503	0.2916
Number of employees/1000	0.8985	2.0407	1.0480	2.2939	2.0731	3.7144
(Number of employees/1000)²	4.9711	62.0930	6.3596	70.7338	18.0893	124.7558
Monthly Wage per employee/100	26.4932	9.3682	26.5706	8.5937	26.1982	9.0448
Export	2.5548	2.7556	2.7706	2.7668	2.9996	2.824
Share of qualified employees	0.61896	0.2594	0.6067	0.2521	0.5754	0.2603
non-German employees	0.1411	0.1213	0.1259	0.1153	0.0370	0.0583
Share of female employees	0.2376	0.1946	0.2240	0.1866	0.2571	0.1924
Work council	0.8612	0.3457	0.8922	0.3101	0.9072	0.2903
Collective bargaining agreement	0.8486	0.3584	0.8740	0.3319	0.8893	0.3139
Sectors						
Manufacturing (Reference)						
Agriculture	0.0228	0.1491	0.0193	0.1374	0.0204	0.1413
Construction	0.0406	0.1974	0.0427	0.2022		
Trade	0.0762	0.2654	0.0630	0.2430	0.0611	0.2395
Finance					0	0
Gastronomy	0.0184	0.1346	0.0116	0.1071	0.0248	0.1557
Health care	0.0354	0.1848	0.0231	0.1502	0.0533	0.2248
Other services	0.1271	0.3331	0.1014	0.3018	0.1148	0.3189
Regions (only West Germany)						
Schleswig-Holstein	0.0225	0.1482	0.0201	0.1405	0.0248	0.1557
Hamburg	0.0408	0.1979	0.0385	0.1924	0.0774	0.2672
Lower-Saxony	0.0738	0.2614	0.0681	0.2519	0.0558	0.2295
Bremen	0.0241	0.1535	0.0232	0.1506	0.0163	0.1266
North Rhine-Westphalia	0.1134	0.3171	0.1159	0.3201	0.1103	0.3134
Hesse	0.2267	0.4187	0.2484	0.4321	0.1926	0.3944
Baden-Württemberg	0.1498	0.3569	0.1418	0.3489	0.2186	0.4134
Bavaria	0.0228	0.1491	0.0212	0.1440	0.0240	0.1532
Establishment Observations	10,194		7,842		2,456	

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