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Competition, Collective Bargaining, and Immigrant Wage Gaps Within German Establishments

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WiSo-HH Working Paper Series
Working Paper No. 35
December 2016

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ISSN 2196-8128

Font used: „TheSans UHH“ / LucasFonts

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Abstract

We study the effects of competitive pressure and collective bargaining on establishment-specific wage gaps between immigrants and natives. Using linked employer-employee panel data for the period from 2000 to 2010, we adjust total wage gaps within establishments for differences in human capital. Controlling for establishment fixed effects, we find that non-German workers face significantly lower wage gaps in establishments covered by collective bargaining agreements, but that no effect from works councils is evident. Using Herfindahl-indices, as well as a subjective assessment of establishments' competitive pressure, we observe that competitive pressure on both product and labour markets reduces unexplained wage gaps by nationality.

Keywords: immigrant wage gap, workplace heterogeneity, competition, collective bargaining

JEL Classification: J15, J31, J71

Acknowledgements: This paper originated from the research project "Quantification of Wage Discrimination according to the German General Equal Treatment Act" within the DFG priority programme "Flexibility in Heterogeneous Labor Markets" (FSP 1169). Financial support by the German Research Foundation (DFG) is gratefully acknowledged. We are particularly grateful for the support of the staff of the Research Data Center (FDZ) at the Institute for Employment Research in Nuremberg.

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1 Introduction

Immigrants make up a sizeable population in Germany and, on average, they receive lower wages compared to natives in the labour market. The total wage gap between German and non-German workers amounts to about fifteen percent (Lang, 2005; Dustmann et al., 2010; Lehmer and Ludsteck, 2011), which is to a great extent explainable by differences in human capital endowments. The remaining (unexplained) wage gap potentially reflects discrimination in the labour market, according to the most widespread approach to measure discrimination, (Oaxaca, 1973). Although the relatively small unexplained wage gap of about five percent (Lang, 2005; Dustmann et al., 2010) suggests that wage discrimination against immigrants is not a prevailing practice in Germany, there is evidence pointing to the presence of segregation and wage discrimination against immigrants. The literature comprises studies that report perceived discrimination by immigrants (Forstenlechner and AlWaqfi, 2010; Antidiskriminierungsstelle des Bundes, 2016a; OECD, 2012), experimental studies that find discrimination in the hiring process (Kaas and Manger, 2011), and econometric studies that show much higher unexplained wage gaps for specific groups of immigrants (Lehmer and Ludsteck, 2011) and quantify different types of wage discrimination (Hirsch and Jahn, 2015; Bartolucci, 2014) and segregation (Glitz, 2014).

The theory of discrimination by Becker (1971) considers employer preferences for different groups of workers with equal productivities as a source of discrimination. Discriminatory behaviour is costly for employers and employers must have some power on product markets in order to afford wage discrimination. Accordingly, product market competition should limit the scope for wage discrimination. Wage discrimination against immigrants can also result from limited competition within labour markets if only a few employers demand labour and if the labour supply of immigrants is less responsive to wages than that of natives (Cain, 1987). Since mobility costs are a reasonable barrier to wage-induced worker mobility, the local availability of competing employers can be expected to reduce monopsonistic wage discrimination (Manning, 2003b). Collective bargaining agreements and works councils usually limit unequal treatment by implementing compliance with norms of equity. Further, collective bargaining redistributes economic rents to workers and therefore reduces employers' scope for preference-based discrimination in the sense of Becker. The limiting effects of competition on discrimination are particularly important in the absence of collective bargaining agreements, and vice versa. We therefore investigate the effects of competition and collective bargaining as well as their interaction on unexplained

wage gaps between German and non-German workers within West German establishments. Unlike other studies, we use linked employer-employee panel data to obtain establishment-specific unexplained wage gaps and focus on testing the implications of discrimination theory regarding competition on product and labour markets, as well as collective bargaining agreements. Exploiting the panel structure of the data, we control for observed and unobserved heterogeneities at the establishment level.

More and more studies have recently considered workplace heterogeneity in the analysis of wage inequality (e.g., Card et al., 2013; Barth et al., 2014). With regard to wage differentials by nationality, race, and ethnicity, several studies decompose the respective wage gap into its within- and between-firm components (Carrington and Troske, 1998; Aydemir and Skuterud, 2008; Aeberhardt and Pouget, 2010) and find that the wage gaps primarily stem from inequality within firms and to a lesser extent from sorting or segregation into high- and low-wage firms. Bartolucci (2014) used information on firm-level productivity and within-firm variation of the native–immigrant composition over time in order to obtain a measure of wage discrimination in Germany (based on Hellerstein et al., 1999). The resulting discrimination parameter is large, indicating that immigrants receive 13 percent lower wages than native workers despite equal productivity in the same firm. While the subsequent finding that firms with higher profits discriminate more speaks against a taste-based discrimination model, previous studies found support for Becker's theory by showing that more intensive competition reduces wage differentials by race (Peoples and Talley, 2001) and gender (Black and Strahan, 2001; Hellerstein et al., 2002; Heinze and Wolf, 2010).

Hirsch and Jahn (2015) present evidence for the monopsony argument (Manning, 2003a). They estimated differential labour supply elasticities of immigrants and natives to the firm and thereby showed that monopsonistic wage setting by employers would almost entirely account for the unexplained wage gap of about three to six percent. Thus, employers may actually profit from discrimination. However, a clear separation of the different discrimination theories remains difficult. In fact, discriminatory preferences against immigrants are in line with monopsonistic discrimination if they impede job offers to immigrants and thus increase search frictions for this group. A general concern regarding the analysis of monopsonistic discrimination is that the underlying sources of differential labour supply elasticities might have a more direct impact on wages than monopsony power (Cain, 1987, p. 719). Directly using variation in the "thinness" of regional labour markets (Manning, 2003b) can circumvent this problem and thus provides an alternative approach to assess the relevance of monopsonistic wage setting to immigrant wage gaps.

We thus contribute to the literature in several ways. We test the implications of different discrimination theories regarding the effects of establishments' competitive pressure on product and labour markets as well as the effects of establishments' coverage by collective bargaining agreements on immigrant wage gaps. The interaction of both effects is of particular interest since the collective bargaining effect should be especially strong if competition in product markets is weak. Investigating these hypotheses not only provides an indirect test of the presence of wage discrimination, as it allows drawing inferences about the type of discrimination at work, but also offers insights regarding the mechanisms that act to reduce wage discrimination in practice.

The remainder of the paper is organized as follows: Section 2 provides theoretical arguments for effects of competition and collective bargaining on wage discrimination. The econometric approach is expounded on in Section 3. Section 4 describes the data and descriptive statistics. Empirical results are presented in Section 5, and Section 6 concludes the findings.

2 Discrimination theory and its implications for employers

Wage discrimination is defined as a difference in wages between two groups of workers with equal productivities due to personal characteristics unrelated to productivity (Arrow, 1973). Theories of discrimination suggest that competitive pressure can reduce the scope of wage discrimination. Further, it can be inferred that wage discrimination within establishments is reduced by collective bargaining agreements and works councils.

According to Becker (1971), wage discrimination arises if employers have preferences for members of one group over those of another despite equal labour productivities. Discriminating employers then act as if hiring foreign workers will not only impose wage costs but also an additional disutility to the firm. As a result, firms with stronger discriminatory preferences against immigrants will tend to hire relatively more natives and relatively fewer immigrants. Further, discriminating firms pay wages above the marginal revenue product to natives and wages below the marginal revenue product to immigrants. This non-optimal allocation of labour causes costs and thus reduces profits of discriminating employers (Becker, 1971). Therefore, a negative correlation between measures of employers' tastes for discrimination, such as the share of the majority group or the unexplained wage differential within firms, and profits is expected (Hellerstein et al., 2002). Becker goes on to argue that discrimination is likely to occur only if employers receive rents due to power in

product markets and that discriminating employers face disadvantages in competitive markets and are eventually driven out of the market. We therefore test the hypothesis that the unexplained wage gap between German and non-German workers is lower in more competitive markets and that an increase of competitive pressure on a firm reduces the wage gap.

An alternative interpretation of employer discrimination is that it does not reflect tastes but perceptions of reality under imperfect information (Phelps, 1972; Arrow, 1973). In this model, employers use an easily observable characteristic such as skin colour to assess workers' productivity based on beliefs or statistics about the productivity of this specific group. This assessment is erroneous because beliefs about immigrants' average productivity may be wrong and because individual productivity is heterogeneous and does not necessarily correspond to the average in the statistics. Hence, this mechanism may lead to a wage differential unrelated to productivity. Interestingly, for the analysis at the establishment level, this theory of statistical discrimination supposes that employers learn about workers' real productivity by incurring costs and time.

The valuation of non-productive worker characteristics can also result from imperfect competition in labour markets. In this case, discrimination may persist even in competitive product markets (Berson, 2016). Employers with monopsony power over labour markets can set wages below workers' marginal revenue product if workers do not react perfectly elastic to wages regarding their labour supply and hence stay at the firm (Robinson, 1933; Cain, 1987). Accordingly, wage discrimination against immigrants may occur if the labour supply of immigrants is less elastic than that of natives. This may be the case for several reasons. Immigrants on average have fewer resources that are necessary to change jobs. First of all, changing one's job often involves relocating or commuting, which is costly. Immigrants may have less social capital and social networks that are limited to ethnic communities and therefore are less likely to receive job offers. If segregation of immigrants by occupation, sector, or region exists, fewer potential employers are available. Given that immigrants experience some job mobility, local market structure plays a role too (Berson, 2016). Monopsonistic discrimination is unlikely if many competing employers are in close proximity to workers. We therefore test the effects of employment concentration among employers in regional labour markets on the German/non-German wage gap.

Since discrimination is illegal, according to the German General Equal Treatment Act of 2006, and regarded as unfair, collective bargaining agreements and works councils can be

expected to promote equality regardless of the causes of discrimination. Unions usually pursue the policy of equal pay for equal work in collective bargaining. Therefore, inequality is typically lesser among workers covered by collective bargaining agreements (Freeman, 1980; Freeman and Medoff, 1984; Fitzenberger and Kohn, 2005). Elvira and Saporta (2001) have argued that collective wage agreements reduce the arbitrariness of wage rates through bureaucratic formalisation, thereby reducing discrimination. Further, collective bargaining as well as firm-level co-determination by works councils may directly pursue the aim of reducing inequality between immigrants and natives as well as between men and women. While collective bargaining agreements standardize wage rates particularly within occupational groups and within establishments (Freeman, 1980), German works councils participate comprehensively in firms' decision-making with regard to hiring, promotions, and layoffs. Works councils often act as equalizing agents by monitoring compliance with corporate or legal principles aimed at achieving equal opportunities and avoiding discrimination (Baron and Bielby, 1984). Accordingly, we test the hypothesis that collective bargaining agreements and works councils are negatively related to unexplained wage gaps between German and non-German workers. Collective bargaining agreements additionally enable workers to participate in economic rents and thus potentially reduce firm profits. Hence, collective bargaining agreements are expected to particularly limit preference-based discrimination if competition in product markets is absent. We thus test if the inequality-reducing effect of collective bargaining agreements is more pronounced in concentrated markets than in competitive markets.

3 Data and description of the sample

The impact of firm characteristics and institutional framework on wage inequality within firms or establishments can be best evaluated with data including linked information on employers and employees. Thus, we use a combined employer-employee panel data set (LIAB) of the Institute for Employment Research (IAB) comprising the IAB Establishment Panel and the IAB Employment Statistics of the German Federal Employment Services. Both data sets contain a unique establishment identifier that allows matching.

The IAB Establishment Panel is an annual survey of German establishments that 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.[1] 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 regarding 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 Statistics of the German Federal Services is an administrative panel dataset of all employees paying social security contributions in Germany (Bender Stefan 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 and self-employed individuals are not covered by this sample. Overall, the Employment Statistics Register comprises about 80 percent of all West German employees. 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 employees' occupation, occupational status, qualification, sex, age, nationality, industry, and size of establishment. The available information on daily gross earnings refers to employment spells reported to the Federal Employment Service by employers. If the wage rate exceeds the upper earnings limit ("Beitragsbemessungsgrenze"), the daily social security threshold is reported instead. Hence, the daily wage rate is censored from above and truncated from below. This problem is approached by applying an imputation strategy specifically developed for these data (Gartner, 2005) in which wages above the threshold are imputed based on tobit estimations for each year of the data.[2]

[1] Note, however, that the terms *firm* and *establishment* are used interchangeably in this paper.

[2] The imputation procedure is based on a tobit model applying the ado-file "imputw" by Gartner (2005). The specification includes 6 educational degrees, age (simple, squared, and cubic), tenure, 10 occupational groups, a gender dummy, a dummy for German or non-German nationality, 11 firm size classes, 9 sector dummies, and state dummies.

Table 1: Description of employee samples

	Germans		Non-Germans	
	Mean	Std. Dev.	Mean	Std. Dev.
Daily wages (in €)	128.96	61.33	110.64	46.16
Log daily wages	4.76	0.46	4.63	0.41
No vocational degree	0.13	0.34	0.45	0.50
Vocational training	0.65	0.48	0.42	0.49
Abitur and vocational training	0.07	0.25	0.03	0.17
University degree	0.16	0.36	0.10	0.30
Share of white-collar workers	0.51	0.50	0.22	0.41
Age (in years)	41.70	9.78	40.68	10.50
Tenure in the establishment (in years)	12.25	8.89	11.29	8.90
Share of women	0.30	0.46	0.25	0.43
Observations	7,492,635		742,853	

Source: LIAB 2000-2010; own calculations

In our analysis of within-establishment wage gaps, we consider only establishments employing at least 10 German and non-German workers, respectively, in order to ensure a minimum of statistical robustness of the estimated wage gaps. Further, the sample is restricted to West German establishments[3] in the private sector[4] that participated in the IAB Establishment Panel in at least one year from 2000 to 2010. Since migration background is not available in the data, workers are distinguished by their nationality.[5] 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.

[3] 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, such that the number of firms with the required number of non-German employees – at least 10 – is too small to derive reliable results.

[4] The wage gap in the public sector is usually significantly lower than in private firms (Melly (2005). Also, competition is unlikely to have effects on pay schemes in the public sector.

[5] The term *immigrant* usually refers to persons who migrated themselves or whose parents 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.

Table 2: Description of establishment sample

	Mean	Std. Dev.	Observations
HHI sectors and states (revenue)	0.18	0.18	9,095
HHI detailed sectors (revenue)	0.19	0.20	9,071
Share of exports in total revenue	29.05	28.70	7,060
Strong competitive pressure (establishments subjective assessment, 1998 to 2010)	0.51	0.50	1,982
HHI sectors and states (employment)	0.10	0.09	9,095
HHI sectors and regional labour markets (employment)	0.30	0.24	9,083
Collective bargaining	0.86	0.34	9,095
Works council	0.91	0.29	9,095
Establishment size	1.15	2.59	9,095
Average wage per worker	28.15	9.52	9,095
Share of women	0.34	0.25	9,095
Share of non-German workers	0.11	0.09	9,095
Share of qualified workers	0.68	0.23	9,095

Source: LIAB 2000-2010; own calculations

Table 1 shows the characteristics of workers considered to determine wages within establishments. The average gross daily wage of West German full-time workers amounts to approximately 129 Euros, while non-German workers earn about 111 Euros, on average. Compared to Germans, non-German workers more often have no (acknowledged) occupational degree and a lower tenure within the establishment, on average. Further, non-German workers tend to be slightly younger, and comprise a clearly lower share of white-collar positions and a somewhat lower share of women.

Workers of non-German citizenship make up about nine percent of our sample. This is comparable to the share of foreign workers in the total population of workers subject to social security contributions in the period under consideration (Statistisches Bundesamt, 2011, p. 92). The largest groups of non-Germans in the sample are people from Turkey (about three percent) and other Southern European countries that had recruitment agreements with Germany in the 1960s. Further foreign populations of considerable size in Germany are from France, Austria, Poland, and the Netherlands.

The variables considered at the establishment level comprise dummy variables indicating the establishments' coverage by a collective bargaining agreement and the presence of a works council at an establishment (see Table 2).

Several measures of competition are applied. Herfindahl-Hirschman indices (HHI) are calculated based on revenue and employment information from the full sample of the IAB Establishment Panel. Revenue (R) at establishments (j) is used to measure concentration of establishments' shares on product markets (Formula 1). Similarly, employment (E) at establishments (j) is used to measure concentration of establishments' shares on labour markets (Formula 2). The HHI is calculated in each combination of different classifications of sectors and regions (s,r). Thirteen aggregated sectors (see Table 4) and the 16 federal states of Germany are used to construct a baseline delimitation of markets. Alternatively, a more detailed sectoral classification (NACE, Rev. 1.1) is applied to consider finer fragmentations of product markets. A classification of 141 regional labour markets is applied to measure labour market concentration within reasonable commuting areas (Kosfeld and Werner, 2012). Given that the establishment panel sample is disproportionate regarding establishment size, market concentration is overestimated. However, this circumstance should apply similarly to sectors, regions, and years. In general, delimitations of markets by sectoral and regional variation are clearly an approximation. Thus, robustness is checked by applying different delimitations. Additionally, establishments' share of exports in revenue is used as a measure of their exposure to international competition and establishments' self-assessment of competitive pressure on product markets (on a four-point scale) is used to further test robustness of domestic competition effects. Hence, a dummy variable was constructed indicating perceptions of "strong competitive pressure" as opposed to "medium," "minor," and "no pressure." This item is, however, only available for the years 2008-2010.

(1) $$HHI\ (Revenue)_{sr} = \sum_{j=1}^{n_{sr}} (R_{jsr} / \sum_{j=1}^{n_{sr}} R_{jsr})$$

(2) $$HHI\ (Employment)_{sr} = \sum_{j=1}^{n_{sr}} (E_{jsr} / \sum_{j=1}^{n_{sr}} E_{jsr})$$

Defining firms' relevant markets is a difficult but important task, "… on which distressingly little work has been done" (Card et al., 2016, p. 35). The study by Manning and Petrongolo (2011) makes a valuable attempt to scrutinize the effective size of local labour markets. Like other existing studies (e.g., Dolton et al., 2015), we address the problem by applying and comparing different delimitations of markets. Both aggregated concentration measures such as the HHI and information based on self-assessments have their specific problems and advantages. Self-assessment survey items have the general problem that individual perceptions may be inconsistent with the objective situation. While self-assessments might better fit the situation of a specific firm, the view of the surveyed person

may differ from that of decision-makers at the firm. In comparison, aggregate measures of market concentration reveal the average intensity of market competition and not the specific competitive pressure to the firm. A further problem of these measures is that their correlation to wages might reflect things other than the effect of competitive pressure (Hirsch et al., 2014). In particular, productivity differences across firms should be controlled for. To accommodate these effects, we include establishment size, the composition of qualified and unqualified workers within establishments, establishments' mean wage, and establishment fixed effects in our models.

4 Methodology

We apply a two-step procedure, which, in its general form, has been applied frequently in the context of heterogeneous within-firm wage differentials (Kramarz et al., 1996; Leonard and van Audenrode, 1996; Heinze and Wolf, 2010). First, wage gaps between German and non-German workers are estimated within each firm as a measure of wage discrimination. Secondly, the resulting unexplained wage gaps are regressed on measures of competitive pressure and co-determination at the establishment level. 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.

We apply the decomposition method of Oaxaca (1973) and Blinder (1973) to differentiate the observed wage gap between German and non-German employees within an establishment into a part explained by differences in the human capital endowments between the two groups and a residual or unexplained part. The absolute wage gap within an establishment is defined simply by the difference of mean log earnings of German and non-German workers within each establishment and year. It is obtained by a wage regression including only a dummy variable indicating foreign citizenship (γ in equation 3) within each establishment observation in the sample. Only establishments with at least 10 German and non-German workers, respectively, were considered.

$$\ln w_i = \alpha + \gamma N_i + \mu_i \tag{3}$$

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 for (at least) one of the two groups. We use an extended Mincer equation among German workers, including dummy variables for the

education level, employees' labour market experience (age and age squared), job tenure within the establishment, and dummy variables indicating employees' sex and blue- or white-collar position (X_{it}^{ger} in equation 4).[6] Again, this regression is run within each establishment in each year.

$$\ln w_i^{ger} = \alpha + \beta_i^{ger} X_i^{ger} + \varepsilon_i^{ger} \quad (4)$$

The establishment-specific unexplained wage gap is then obtained by Oaxaca-Blinder decomposition (Oaxaca, 1973; Blinder, 1973) (5):

$$Gap^{unexp} = Gap^{obs} - \hat{\beta}^{ger}(\overline{X_{it}^{ger}} - \overline{X_{it}^{for}}) \quad (5)$$

Several potentially relevant individual characteristics, such as language skills and the degree of integration/assimilation, are not observed in the data. Therefore, the obtained unexplained wage gap can be viewed as an upper bound of wage discrimination or a measure of potential discrimination.[7]

In the second step of the analysis, the unexplained establishment- and year-specific wage gaps (Gap_{jt}^{unexp}) are used as a dependent variable to analyse the relationship with competition and institutions of worker codetermination (equation 6). Establishments' exposure to competitive pressure (C_{jt}) is captured by the concentration of revenue in different delimitations of product markets by sector and region. Additionally, the establishments' export quota is used to measure firms' exposition to international competition. For the years 2008 to 2010, a self-assessment of competitive pressure to the establishment is available. The institutional framework (I_{jt}) is accommodated by dummy variables on the existence of a collective wage agreement and a works council. Further, we control for the average wage level within the firm, an establishment's share of female employees, the share of non-German and qualified employees, and year dummies (Z_{jt}).

As an alternative to OLS models, we include fixed establishment effects αj in order to analyse the effects of changes within establishments over time. Accordingly, all unobserved time-invariant heterogeneity on the establishment level is controlled for and the coefficients

[6] Given the limited information available at the individual level, we include distinctions of blue- and white-collar positions and gender to get closer to the concept of equal pay for equal work.

[7] Additionally, some 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 about the *household* context and individual background, it is difficult to implement this procedure, which requires convincing exclusion restrictions.

of the variables of interest are more likely to reflect causal relations. It also mitigates the problem that the HHI may capture things other than competition/market concentration.

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

5 Results

5.1 Wage gaps within establishments

The total wage gap between German and non-German workers within establishments amounts to 11.1 percent, on average. Oaxaca-Blinder decomposition shows that this wage gap is to a great extent caused by differences in education, work experience (age and tenure in the establishment), and the share of blue- or white-collar workers between these two groups. On average, a wage differential of 0.9 percent remains unexplained. These values are smaller than in the majority of other studies because we considered only relatively large establishments with more than ten workers in each group. Also, we included more than the typical Mincer covariates in the decomposition of the wage gap, extending it by occupational status (blue- or white-collar) and gender.[8] Overall, our results confirm the finding from other studies that the unexplained wage gap by nationality is, on average, modest in Germany (Licht and Steiner, 1994; Lang, 2005; Lehmer and Ludsteck, 2011; Hirsch and Jahn, 2015).

In a previous version of this paper, we assessed the importance of immigrant sorting into lower-paying firms (Beblo et al., 2012). We found a disparity of about 5 percentage points between the absolute wage gap in the labour market and the average absolute wage gap within establishments, indicating a selection of non-German workers into low-wage firms due to differences in education. No such selection was found once differences in human capital between the two groups were controlled for. Hence, discrimination in the hiring process did not become apparent in the data.

[8] Omitting occupational status yields an average unexplained wage differential that is about one percentage point larger.

Table 3: Description of wage gaps over time

	Observed wage gap			Unexplained wage gap			Observations
	Mean	Std. dev	Coefficient of variation	Mean	Std. dev	Coefficient of variation	
2000	0.126	0.115	0.914	0.005	0.084	15.585	942
2001	0.122	0.114	0.935	0.004	0.086	21.051	1,012
2002	0.122	0.121	0.999	0.010	0.091	9.216	1,005
2003	0.115	0.115	1.002	0.007	0.084	11.541	835
2004	0.106	0.128	1.216	0.006	0.085	15.258	882
2005	0.110	0.129	1.170	0.011	0.090	8.232	894
2006	0.103	0.142	1.376	0.008	0.092	10.978	818
2007	0.102	0.133	1.303	0.009	0.092	9.827	709
2008	0.101	0.138	1.361	0.013	0.091	7.216	731
2009	0.103	0.137	1.324	0.018	0.092	5.238	687
2010	0.100	0.134	1.335	0.017	0.096	5.791	580
Total	0.111	0.127	1.145	0.009	0.089	9.606	9,095

Source: LIAB 2000-2010; own calculations

Table 4: Wage gaps by sector

	Unexplained wage gap			Observations
	Mean	Std. dev	Coefficient of variation	
Agriculture	-0.003	0.108	-33.244	27
Mining, energy	0.039	0.085	2.156	116
Manufacturing	0.001	0.062	97.577	5,136
Construction	0.039	0.073	1.859	245
Trade, repair	0.026	0.104	4.002	581
Logistics	0.018	0.073	4.169	313
Hotels and restaurants	0.058	0.096	1.662	57
Information, communication	0.081	0.137	1.704	32
Finance, insurance	0.048	0.109	2.286	323
Services (business)	0.037	0.123	3.311	584
Education	0.082	0.145	1.766	162
Health care, social work	-0.016	0.118	-7.515	1,191
Other services	0.027	0.116	4.321	328

Source: LIAB 2000-2010; own calculations

While the total wage gap within establishments decreased slightly over the years under review (see Table 1), the residual wage gap increased in that period. This implies that the differences in education and work experience between the two groups became smaller, whereas differences in the remuneration of these factors between Germans and non-Germans remained unchanged. Although the distribution of the unexplained wage gap across establishments is less dispersed than the distribution of the total wage gap, its variation is

substantial. The unexplained wage gaps range from about 90 percent lower wages for non-German workers to about 45 percent higher wages compared to German workers depending on the specific establishment.

Substantial sectoral differences were also apparent in within-establishment wage gaps between German and non-German workers. While the average unexplained wage gap is close to zero in manufacturing, it is particularly large in education, hotels, and restaurants, as well as the information and communication sector. These sectoral differences might be due to the importance of language skills and/or contact with customers. However, as we will explore next, these differences are likely to stem from differences in sectoral coverage by collective bargaining agreements as well as sectoral intensity of competition.

The estimation of the wage gaps is based on wage regressions among German workers within establishments. The estimated coefficients of individual wage determinants, on average, leads to the expected results: employees with higher educational degrees and more experience receive higher wages, while the marginal returns to experience are diminishing (Table 2). Further, it becomes apparent that substantial variation exists in returns to individual characteristics across establishments. Establishments differ particularly in their remuneration to firm-specific human capital measured by tenure in the establishment. All within-establishment coefficients are, for the most part, significantly different from zero at the five percent level.

Table 5: Description of wage regressions within establishments

	Mean of coeff. estimates	**Mean of t-values**	**Share of coeff. at 5%-significance level**	**Coefficient of variation**
No vocational degree	reference			
Vocational training	0.10	2.73	0.58	1.05
Abitur and vocational training	0.18	2.46	0.54	1.03
University degree	0.39	7.30	0.88	0.50
White-collar	0.27	9.19	0.91	0.48
Age	0.04	4.28	0.74	0.70
Age squared	0.00	-3.73	0.69	-0.75
Tenure	0.01	3.89	0.71	2.32
Women	-0.21	-6.95	0.92	-0.55
Constant	3.61	22.73	0.99	0.16
Observations	9,095			

Source: LIAB 2000-2010; own calculations

5.2 Analysis of establishment heterogeneity

Table 6 shows the full set of results for the establishment-level regressions, including the HHI, which measures the concentration of revenue for each combination of aggregated sectors and states. The effects of alternative indicators of market competition are presented in section 5.3.

The HHI is positively related to the wage gap of foreign workers in all displayed specifications: A greater concentration of revenue in a market coincides with higher wage gaps within firms. When establishment-specific unobserved heterogeneity is controlled for by including establishment fixed effects, the effect of market concentration is much smaller but still significant. These findings can be interpreted as evidence of a negative effect of competition on unexplained wage gaps.

The effect of collective bargaining on the unexplained non-German wage gap is not significant in an OLS regression including control variables. It is, however, negative and highly significant in the establishment fixed effects specification. It can be inferred from this model that exiting a collective bargaining agreement increases the unexplained wage gap by 1.3 percentage points. This indicates that the wage gap is almost zero on average in establishments that are subject to collective bargaining, which offers strong evidence for the notion that collective bargaining reduces unexplained wage gaps and, hence, possibly wage discrimination as well. This effect remains robust when other measures of competition are considered (section 5.3). Works councils do not have a significant impact on this dimension of wage inequality within establishments in any of the regressions. The interaction of the presence of collective bargaining and the HHI shows that the effect of competition is smaller in the presence of collective bargaining. This difference in the effects of competition is not significant. However, the result is consistent with the finding that establishments covered by collective bargaining agreements have less discretion to adjust wages to changes in competitive pressure, or to conduct wage discrimination in the first place.[9]

[9] See Hirsch *et al.* (2014) for a similar result regarding gender wage differentials.

Table 6: Establishment characteristics and the German/non-German wage gap

Variable	Bivariate	OLS	Establishment fixed effects	Establishment fixed effects with interaction
HHI sectors and states (revenue)	0.074***	0.072***	0.015*	0.033*
Interaction HHI and collective bargaining	-	-	-	-0.20
Collective bargaining	-	-0.001	-0.013***	-0.010*
Works council	-	-0.005	-0.006	-0.006
Establishment size	-	-0.000	-0.003	-0.003
Establishment size squared	-	0.000	0.000	0.000
Average wage per worker in establishment	-	-0.000	-0.000**	-0.0004***
Share of women in the establishment	-	-0.018*	0.011	0.011
Share of non-German workers in the establishment	-	-0.031	0.141***	0.142***
Share of qualified workers in the establishment	-	0.020**	0.012	0.012
Constant	-0.004**	0.011	0.006	0.003
Observations	9095	9095	9095	9095
R^2-adjusted	0.022	0.027	-	-
R^2 within/between	-	-	0.0094/0.0002	0.0097/0.0002

* p<0.05; ** p<0.01; *** p<0.001

Year dummies are included additionally

HHI is obtained from the full sample of the IAB-Establishment Panel

Source: LIAB 2000-2010; own calculations

Interestingly, there is no significant relationship between the share of foreign workers and the unexplained wage gap of foreign workers within establishments in the OLS model. A negative relationship would be expected based on discrimination theory since discriminating employers hire fewer immigrants and hire them at lower wages when they do hire non-Germans. It turns out that a negative relationship is found using the between estimator, i.e., a comparison of establishments within several cross-sections of data.

An increase of non-German workers over time, as analysed in the fixed effects model, has a highly significant increasing effect on the unexplained wage gap between German and non-German workers. This finding could be due to newly hired foreign workers facing more pronounced disadvantages, which would be in line with statistical discrimination theory.

Further inquiry of the progression of immigrant wage gaps within the workplace over time would be desirable but is beyond the scope of this article.

In addition, the small but significant negative effect of an establishment's average wage level per worker shows that well-paying firms have more equitable wage systems. The corresponding coefficient from a fixed effects model shows that an increase in an establishment's wage level reduces the immigrant wage gap. Firms with a higher share of qualified workers among their workforce have larger unexplained wage differentials than those with fewer qualified workers. However, a change in the share of qualified workers does not affect the wage gap.

5.3 Alternative competition measures

A comparison of the effects of different indicators of competition overall support the finding that unexplained nationality wage gaps are smaller in establishments facing more intense competition (Table 7). However, only some of the models that control for unobserved heterogeneity by establishment fixed effects document significant effects of a change in competitive pressure over time.

All measures indicate a positive relationship between market concentration and the establishments' unexplained wage gaps in bivariate regressions. The results are similar when controls of observed establishment characteristics are added in an OLS model. Compared to our main model that includes revenue concentration within aggregated sectors and states (section 5.2), a change in concentration over time does not have a significant effect when markets are delimited by detailed sectors. This means that either regional aspects at the state level matter for employer power in product markets or that the classification of about 300 sectors (NACE) is too detailed to measure market concentration based on an establishment sample. Although the interaction with collective bargaining is not significant, the finding from the main model is reproduced that market concentration has a noteworthy positive effect only when collective bargaining is absent.

The effect of establishments' share of exports, as a measure of international competition, on the unexplained wage gap is very small. Nevertheless, the results point in the same direction as the models that include measures of domestic competition. The coefficient estimate of the establishments' self-assessment confirms a negative relationship between competition and unexplained nationality wage gaps, but is only significant in the bivariate model and clearly lacks a sufficient number of cases for further scrutiny. The self-assessment,

however, has the advantage of directly assessing competitive pressure at the establishment level. Therefore, it provides an important test of the aggregated competition measures' validity. Holding other establishment characteristics constant, the effect of competition on product markets simply appears to be small.

The concentration of employment within labour markets is positively related to the size of the unexplained wage gap in all models considered. A significantly positive impact of employment concentration within sectors and states on the unexplained wage gap is evident, both in the OLS model and in the fixed effects model. Similar effects are confirmed if employment concentration is measured within regional labour markets. Hence, these findings are in line with the theory of monopsonistic discrimination.

The interactions of the effects of competition on labour markets are not statistically significant. Within regional labour markets, the interaction shows that the effect of market structure is smaller in the presence of collective bargaining. However, the effect is particularly large among establishments covered by collective bargaining agreements if concentration of labour markets is measured at the state level.

The results show that the effects of different measures of competition are similar in direction but that there is considerable variation in size. This highlights the importance of good indicators of market structures and their relevance to single establishments. By using Herfindahl indices as our main indicator, we followed a traditional approach and applied it to linked employer-employee data, with the hope of stimulating further research in this area. Improvements could be achieved by constructing concentration measures from complete census data. Also, in the future, the analysis of establishments' self-assessment of competitive pressure will be available over a longer time span. In the analysis of monopsony power of employers, the estimation of differential labour supply elasticities of groups in the labour market provides an alternative approach to identify the relationship between market structure and wage discrimination. Applying this approach, Hirsch and Jahn (2015) found that monopsonistic wage discrimination can explain almost the entire observed unexplained wage gap.

Table 7: Effects of alternative competition measures

	Bivariate	OLS	Establish-ment fixed effects	Establish-ment fixed effects with interaction	Obser-vations
Competition on Product Markets					
HHI detailed sectors (revenue)	0.047***	0.048***	0.001	0.012	9,093
Interaction with collective bargaining	-	-	-	-0.012	9,093
Share of exports in total revenue	-0.0003***	-0.0003***	-0.0001	-0.0002	7,060
Interaction with collective bargaining	-	-	-	0.0002	7,060
Strong competitive pressure (establishments subjective assesment, 1998 to 2010)	-0.009*	-0.007	-0.004	0.003	1,986
Interaction with collective bargaining	-	-	-	-0.008	1,986
Competition on Labour Markets					
HHI sectors and states (employment)	0.114***	0.104***	0.030*	-0.003	9,137
Interaction with collective bargaining	-	-	-	0.038	9,137
HHI sectors and regional labour markets (employment)	0.015***	0.008	0.015*	0.025	9,125
Interaction with collective bargaining	-	-	-	-0.011	9,125

* p<0.05; ** p<0.01; *** p<0.001

Other covariates are the same as in the main model (section 5.2)

Source: LIAB 2000-2010; own calculations

Regarding the measurement of wage discrimination, we applied Oaxaca-Blinder decompositions into explained and unexplained wage differentials between immigrants and natives at the establishment level. A disadvantage of this approach is that unobserved attributes related to worker productivity cannot be considered. For instance, immigrants' difficulty with German language fluency could economically justify wage differences that

cannot be discerned as discrimination. The approach by Hellerstein et al. (1999), which Bartolucci (2014) recently applied to Germany, is an improvement in this regard. However, in terms of the relationship between establishment wage gaps and competition, the suggested importance of unobserved individual factors does not appear reasonable. It is unclear why language skills or social integration should be valued more in less competitive markets for economic reasons.

Taken together, our evidence does suggest that competition, in both product and labour markets, limits unexplained wage gaps between German and non-German workers at the establishment level. While it is clearly documented that unexplained wage gaps are smaller in establishments facing stronger competition, a causal effect based on a change in competitive pressure, derived from the estimation with establishment fixed effects, is of weaker statistical significance.

6 Conclusions

This study provides an analysis of the wage differentials between German and non-German workers within establishments. We investigate the impact of competition, collective bargaining, and its interaction. The analysis is based on linked employer-employee panel data, which combines information on all employees in observed establishments of the IAB Establishment Panel.

The average total wage gap between German and non-German workers within establishments has decreased slightly over time, from about 12 percent in 2000 to about 10 percent in 2010. This wage gap is to a great extent caused by differences in education and work experience between German and non-German employees. The resulting unexplained wage difference amounts to only about one percent, on average, but has increased over time and varies substantially across establishments. The methodology of the study at hand acknowledges that remunerations in the labour market do not only vary by individual characteristics but also between firms and establishments. It is inferred from discrimination theory that this variance can be explained to some extent by establishments' market situation and institutional framework. Our results clearly indicate that non-German workers face significantly lower wage discrepancies in establishments covered by collective bargaining agreements, but we find no effect of works councils on unexplained wage gaps by nationality. While our research design is better suited to analyse competition on product markets, results suggest that competition in both product and labour markets reduces unexplained wage gaps

within establishments. A clear separation of these two forms of discrimination remains difficult, however. Theoretically, the presence of taste-based discrimination reduces the number of employers available to immigrants and therefore potentially leads to monopsonistic discrimination (Berson, 2016).

Other recent empirical studies have concluded that nearly the entire unexplained immigrant wage gap can be explained by monopsonistic wage setting (Hirsch and Jahn, 2015). Bartolucci (2014) interprets a negative correlation of firm profits with a firm-specific discrimination parameter as evidence against discrimination based on taste. Complementary to these earlier findings, our results confirm a limiting factor of taste-based discrimination against immigrants – competition on product markets. This limiting effect is larger among establishments not covered by collective bargaining agreements.

Our results add to previous research that points to the presence of discrimination against immigrants in Germany. The clear finding of a limiting effect of collective bargaining on unexplained wage gaps suggests that disadvantages experienced by immigrants in Germany would be less significant today if collective bargaining coverage had not eroded. Under the present circumstances, consideration of national regulations that seek to foster wage equality and fair treatment is warranted. The General Equal Treatment Act from 2006 prohibits discrimination due to race, ethnicity, gender, religion, ideology, disability, age or sexual identity. A recent evaluation of this act concluded that some revisions are advisable; e.g., expanded time limits to sue for discrimination and the ability for associations to file lawsuits in the name of those affected (Antidiskriminierungsstelle des Bundes, 2016b). Further, an act designed to strengthen collective bargaining came into force in August 2014. Its main component was the introduction of a general minimum wage in January 2015, which may help to prevent unfair treatment of immigrants, particularly those at the lower end of the wage distribution. At the same time, our results place emphasis on the importance of competitive markets for wage equality. Hence, the investigation of market concentration by competition authorities can, alongside its other purposes, be regarded as a measure to support fairness in the labour market.

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