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Max Friedrich Steinhardt

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Max Friedrich Steinhardt
Hamburg Institute of International Economics (HWWI)
and Centro Studi Luca D'Agliano (LdA)
steinhardt@hwwi.org

HWWI Research Paper
Hamburg Institute of International Economics (HWWI)
Heimhuder Str. 71 | 20148 Hamburg | Germany
Phone +49 (0)40 34 05 76 - 0 | Fax +49 (0)40 34 05 76 - 776
info@hwwi.org | www.hwwi.org
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The wage impact of immigration in Germany- new evidence for skill groups and occupations

Max Friedrich Steinhardt*

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The paper contributes to the ongoing debate about the adequate technique to identify the impact of immigration. Initially the regression analysis on the basis of education-experience cells reveals that the impact of immigration on native wages in Germany is negative, but small. The subsequent analysis on the basis of occupations using the same data yields a considerably higher adjustment coefficient and indicates strong wage effects within primary service occupations with a magnitude comparable to results for the US. The analysis therefore demonstrates that the use of formal qualifications as an exclusive classification criterion may lead to an underestimation of the impact of immigration.

JEL Classification: C23, J15, J31, J42, J60
Keywords: Labour market impact of migration, skill group approach, occupations, fixed effects model

* Hamburg Institute of International Economics (HWWI) and Centro Studi Luca D'Agliano (LdA). E-Mail: steinhardt@hwwi.org, max.steinhardt@guest.unimi.it.

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1 Introduction

In 2005 Germany launched a new Immigration Law, which is the first comprehensive law in the history of the Federal Republic of Germany that combines the issues of integration and immigration. However, immigration has had a long tradition in Germany. This is documented by the latest census of the Federal Statistical Office of Germany (2008) which attests that almost 18.4% of the German population has a migration background. One of the major questions in the economic and political discussion of migration is in which way immigration affects the labour market outcomes of the native population.

From a theoretical perspective, immigration can have different impacts on the wages and the employment of the native population. In a simple, comparative model with homogenous labour immigration of foreign workers leads to a displacement of native labour in combination with a decline in wages. The more inelastic the supply and demand relationships, the greater will be the decline in native wages due to a given amount of immigration. The displacement effect will increase the more elastic the labour supply and the less elastic the demand of labour (Greenwood and McDowell 1986: 1745). If the assumption of homogenous labour is dropped and the idea of heterogeneous labour is introduced, the impact of immigration depends on the relationship between the different factors of production. In general, the factors of production which are substitutes for immigrant labour exhibit a decline in their returns, which means that the wages of the native workers decrease. Inversely, factors of production which enjoy a complementary relationship with immigrant labour will experience a rise in return. In the case of labour markets with rigidities, the immigration of foreign workers can influence the existing unemployment of the native population (see amongst others Greenwood and McDowell 1986: 1745-1750, Borjas 1994: 1695-1700, Bauer 1998: 40-42).

The aim of the paper is to contribute new empirical evidence on the wage impact of migration in Germany by extending the analysis to occupational labour markets. The study is based on employment sample from the Institute of Employment research (IAB) covering the time period from 1975 to 2001. At first, the wage effects of immigrations are analysed at the level of skill groups as defined by Borjas (2003) and already adopted by Bonin (2005). The replication of this approach confirms previous findings and shows that immigration only has a small impact on native wages: An inflow of immigrants increasing the number of employees in a skill group by 10% leads to a reduction of native wages by less than 1%.

Secondly the analysis is extended to the level of occupations based on the idea that in Germany foreigners and natives within a skill group are unlikely to compete for the same jobs. In this case the use of the classical skill group approach will lead to biased results. Initially we demonstrate that natives and foreigners with similar educational attainment indeed specialize in different occupational segments. The subsequent empirical analysis yields a considerably larger adjustment coefficient (-0.189) than within the skill group framework and indicates that special occupational groups in Germany have suffered strong adverse wage effects: An immigration inflow which increases the number of employees within the group of service occupations by 10% causes a reduction in native wages by 3.9%. The size of the impact is remarkable and comparable to the ones found in the US. Therefore the study highlights the importance for future studies to extend the analysis to the level of occupations, since the exclusive use of the observed education characteristic risks biased estimates. This methodological extension contributes to the ongoing debate about the adequate technique to identify the impact of immigration which centres on the question of substitutability of native and foreigners (see Borjas 2003, Ottaviano & Peri 2006, D`Amuri et al. 2008, Brücker and Jahn 2008, Borjas 2009).

The paper is organized as follows: Section 2 contains a review of the previous literature. In Section 3 the methodological approach is presented and the estimation equations are specified. Section 4 contains a short description of the IAB employment sample and a documentation of the various procedures that were implemented to construct a dataset with an appropriate structure. Section 5 contains a short description of German immigration history and descriptive statistics of the central dependent and independent variables. In Section 6 the results of the estimation are presented. The paper ends with a conclusion in section 7, which summaries the results of the paper and points out implications for further studies.

2 Related literature

Most previous empirical studies of the labour market effects of immigration in the U.S. were based on a spatial approach, comparing the share of immigrants in states, regions or metropolitan areas with native wages or unemployment (see amongst others Grossman 1982, Altonji and Card 1991). Typically these studies do not find strong evidence of a negative impact on native labour market outcomes. This may be due an endogeneity of the location decision and adjustment processes in the local labour market. A noteworthy methodological exception is the study of Card (1991) who makes use of a natural experiment by analysing the

impact of the Mariel Boatlift on the labour market of Miami. However, even in this framework he found no negative impact on native wages.

In response to mentioned caveats of the spatial approach Borjas et al. (1992) implemented a factor proportion approach to identify the impact of immigration on native labour market outcomes.[1] Depending on the functional form and number of factors these models can yield sizable negative wage effects for native workers. However, Ottaviano and Peri (2006) demonstrated that by allowing imperfect substitution between natives and foreigners and endogenous capital accumulation these models can predict a positive immigration effect on native wages. A main critique of this approach is that the labour market impact is not directly observed, but predicts for a given elasticity of substitution the relative wage consequences of supply shifts mechanically (Borjas 2003: 1338-1339).

For this reason Borjas (2003) introduced the skill group approach which identifies the impact of immigration at the national level on the basis of qualification groups. In a recent paper this approach was used for cross-country comparison between the US, Canada and Mexico, finding similar responses in wages and significant differences in changes of the wage structure across countries (Aydemir and Borjas 2007). The papers have in common that they find strong negative impacts of immigration on the labour market outcomes of the native population for the US. In his seminal work Borjas (2003) finds that an immigrant inflow increasing the number of workers in a skill group by 10 percent reduces native annual earnings by 6.4 percent. An alternative methodological approach is introduced by Card (2001) and Orrenius and Zavodny (2007) who extend the analysis to the level of occupations. Both studies find as well significant negative effects on native labour market outcomes.

The first empirical study on the labour market impact of immigration for Germany was conducted by DeNew and Zimmermann in 1994, who divide the national labour market into industry labour markets and differentiate between white- and blue collar workers as a proxy for skills. Their result is that an increase in the share of foreign workers by one percentage point leads to a decline in native wages by 4.1% which is by far the strongest effect that can be found in the literature for Germany. Until 2005 almost all empirical studies analysing the labour market effects of immigration for Germany were based on the spatial or factor

[1] For a comprehensive overview over the different empirical approaches in the literature on the labour market impact of immigration see Okkerse (2008).

proportion approach. A prominent example for the application of the spatial approach is the study of Pischke and Velling (1997) who analysed the impact of immigration on native labour market outcomes in German regions. The authors did not find any evidence for negative effects on native wages, but a negative impact on native labour force participation. The skill group approach of Borjas (2003) was first adopted by Bonin (2005) who finds the result, that an increase of the foreigner share by 10% relative to the native workforce within a skill group reduces natives wage by 1.02%. Two recent studies for Germany were conducted by D`Amuri et al. (2008) and Brücker and Jahn (2008). While the first one adopts the general equilibrium model setting of Ottaviano and Peri (2006) the second estimates the impact of immigration by using a wage curve approach. Both studies have the result that immigration has no negative or even a slight positive impact on native wages.

3 Methodological approach

As pointed out earlier, most of the empirical studies on the labour market impact of immigration have used regional criteria like metropolitan areas or federal states to define closed labour markets. This classification suffers from various problems: First, the spatial classification neglects the fact that immigrants prefer regions with high wages and low unemployment. Therefore the location decision of immigrants is not randomly distributed but is endogenously determined. Second, native workers can react with emigration to the inflow of foreign workers, avoiding shrinking of wages. Furthermore, capital can reallocate to these areas due to the cheap labour supply (Grossman 1982, Borjas 1994, Velling 1995). For this reason the present study analyses the immigration effect at the national level using qualifications and occupations as a classification criterion.

In the original skill group approach of Borjas (2003) the national labour market is divided into different skill groups, whereas the membership of an individual in a skill group is defined by her/his recorded education and work experience. The inclusion of the labour market experience as a second criterion besides education is motivated by findings of human capital theory, which indicate that experience in the job has a high relevance for labour market performance (Mincer 1973). The basic idea of Borjas` approach is that the native workforce within a skill group is relatively fixed which reduces the potential of native flows across skill groups in reaction to immigration. The key assumptions of the approach are that workers with similar education and different experience are imperfect substitutes and that immigrants within one education-experience cell have a similar occupational distribution.

The present paper complements the analysis by an alternative approach following the observation that in Germany natives and foreigners work in different occupational segments despite similar education and experience. One reason for this is the inadequate transferability of educational attainment of immigrants from the source to the host country. In Germany this is strongly enforced by the high relevance of formal qualifications on the labour market. Nevertheless Germany up to the present has no standardized legal system for the recognition of foreign degrees. As a consequence is the rate of recognised foreign qualifications in Germany uncommonly low (Englmann and Müller 2007). For this reason a foreigner might be recorded in the data set as having no apprenticeship, although he has one from abroad. Or he reports himself as having a vocational training, but he is not able to make use of it on the German labour market.

Another more general explanation is that immigrants and natives exhibit several differences which are relevant to labour markets irrespective of their education and experience. Immigrants are likely to have different abilities than natives concerning language, quantitative skills, and relational skills which might affect their occupational distribution (Ottaviano and Peri 2006). In line with this Amuedo-Dorantes and de la Rica (2008) as well as Peri and Sperber (2009) argue that immigrants have a comparative advantage, relative to their native counterparts, in performing manual tasks as opposed to interactive tasks. Last but not least discrimination or institutional barriers might hinder immigrants finding jobs that match their qualification.[2] Any of these cases would imply that immigrants and foreigners with comparable formal education and experience work in different occupations, leading to biased results when applying the classical skill group approach. Indeed studies for UK and Spain indicate that the task specialization of immigrants and natives with similar formal education and experience strongly differs (Dustmann et al (2008), Amuedo-Dorantes and de la Rica (2008)). Furthermore have Constant and Massey (2005) demonstrated that the German labour market is characterized by a substantial degree of occupational segmentation between natives and immigrants. For these reasons it seems reasonable to extend the analysis to the level of occupations.

[2] Actual examples for the latter are the implemented transitional measures after the EU enlargement in 2004, which suspended the free movement of workers from the New Member States (NMS) and the bilateral agreements between Germany and the Central and East European (CEE) countries which grant temporary access to particular sectors of the German labor market.

The subsequent empirical analysis is based on a reduced-form labour demand function. The share of immigrants is integrated in a specified wage equation for native workers as the main explanatory variable of interest. Therefore the wage is not only determined by individual characteristics of the native workers but also by the share of the immigrant workforce. The estimated coefficient of the migration variable then shows whether migration has a positive or negative impact on the wages of the native workforce (Bauer 1998, Borjas 2003). Besides the estimation of the individual level, the wage equation can be estimated at the so-called meso-level (Velling 1995: 255). This means that the submarket itself, in this case skill groups or occupational groups, are chosen as the unit of analysis. Furthermore we model the time dimension, which allows us to consider both longitudinal and cross-sectional variance in the analysis. The impact of immigration on the wage level of skill groups can be estimated by the following equation:[3]

$$(1) \qquad \ln w_{it} = \alpha_0 + \alpha_1 m_{it} + \alpha_2 S_i + \alpha_3 A_i + \alpha_4 \lambda_t + \alpha_5 S_i A_i + \alpha_6 S_i \lambda_t + \alpha_7 A_i \lambda_t + \varepsilon_{it}$$

where $\ln w_{it}$ denotes the average wage in skill group i at time t in logarithms, and m_{it} the share of employed foreigners M in overall employment (N+M) in the skill group i at time t (m= M/(M+N)). The Variable ε_{it} represents a group specific error term with normal distribution. The wage effects of immigration are reflected in the coefficient α_1 of the migration variable.

The variables S_i und A_i describe the education and work experience of the members of a skill group.[4] S_iA_i is the interaction effect of education and experience and is included to control for the fact that the experience profile for a particular labour market outcome differs across educational groups. The variable λ_t is a time period dummy, and controls for cyclical effects on the dependent variable. $S_i\lambda_t$ and $A_i\lambda_t$ stand for interactions between cyclical effects and education or experience. The inclusion of these terms allows us to control for the possibility that the wage effect of education and experience changes over time. Furthermore the presence of the interaction terms ensures that the wage effect of immigration within education-experience cells is identified over time (Borjas 2003: 13-14). Equation (1) allows the estimation by *Dummy Variable Regression* or *Least Squares Dummy Variable (LSDV)*

[3] An alternative approach is used by Brücker und Jahn (2008) who analyse the immigration impact on the basis of a wage curve, applying a structural approach that determines employment and wages simultaneously in a general equilibrium framework.

[4] Because of the fact that skill groups were chosen at uniform aggregate level, the education and experience variables have no time index.

Regression, in which for every cross-sectional observation a dummy is included (Wooldridge 2002: 272-273).[5]

Parallel to this, the impact of immigration on native employment outcomes can be estimated by regressing the average wages of natives in occupation group *O* on the fraction of foreigners:

$$(2) \qquad \ln w_{ot} = ß_0 + ß_1 m_{ot} + ß_2 OC_o + ß_3 A_o + ß_4 \lambda_t + ß_5 OC_o A_o + ß_6 OC_o \lambda_t + ß_7 A_o \lambda_t + \varepsilon_{ot}$$

where o indexes the occupational group and t indexes years. The term OC_o describes the occupational field to which the members of the occupational group belong.

4 The data and operationalisation

The regional file of the employment sample 1975 to 2001, in the following called IABS, is a micro data set which is drawn from the employee and recipient history of the Institute for Employment Research (IAB). The legal basis of the dataset is the integrated reporting procedure regarding pension, unemployment and health insurance. The data is a 2 percent random sample of all employees covered by social security. The used data set therefore has more than the double size of the data used by Bonin (2005) who exploits the previous version of the IAB employment sample, which covers 1 percent of all employees liable to social security contributions during the period 1975 to 1997. Accordingly to the construction of the sample self employed, family workers and civil servants (Beamte) are not included. The dataset represents 80 percent of the employees in Germany. The data is used for calculating the benefits from the social security system and is therefore highly reliable. It contains information about a number of sociodemographic, employment-and benefit-related characteristics (Bender and Haas 2002).

As a first step all observations from the dataset are deleted that referred to the New Laender. This is inevitable because the dataset only contains information about the nationality of employees for the western part of Germany. In a second step the dataset is restricted to

[5] This method is a simple version of a fixed-effects model, which allows us to integrate the fixed effects explicitly in the estimation equation. Alternatively to the inclusion of dummies for education, experience and its interaction a unique dummy for skill groups could be included in the equation. Because of the higher information content the first solution was selected. There is no difference between both methods concerning the estimation results of the immigration effect.

individuals who are full-time employed or receiving public benefits.[6] In a third step, the data is corrected for overlapping notifications so that for every period only one notification exists.[7] Eventually cross-sections are taken at every 30th of June.

Whereas the education of an individual is given in the IABS, the data contains no variable that describes the work experience of an employee. For this reason the work experience is approximated by subtracting the average age of labour market entrance from the actual age of an employee. However, this method is only applicable for men, because it assumes a continuous employment history, which may be an unrealistic assumption for some women (Fitzenberger et. al 2004: 97-98, Bonin 2005: 7-8). Because of this, all the data for female employees is omitted. The analysis of the immigration effect is therefore only related to the male workforce. Data from the IAB education report is used for the determination of the age of labour market entrance (Reinberg and Hummel 1999).[8]

In the next step, the skill groups described in section 2 are constructed. All individuals are allocated to a skill group by using their education and experience as a classification criteria. Whereas the education variable is used without modification, the work experience is scaled into intervals of two years.[9] By the combination of b=1,..6 education categories and a=1,..12 intervals of work experience, 72 skill groups are constructed. Compared to Bonin (2005) the classification of skill groups uses a finer definition related to education as well as experience. This follows the idea that a too broad classification scheme might violate the crucial assumption that natives and foreigners within a skill group are perfect substitutes and bias the results.[10]

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[6] The employment sample contains only information about the average daily gross earnings and no details about the hours worked and hourly wages.

[7] To ensure the correct coverage of the benefit payments in the panel analysis, all benefit notifications that run over more periods, have to be divided at the end of a year retrospectively.

[8] For the average age of labour market entrance following values are approximated according to the classification of the IAB employment sample: 17 years for individuals without apprenticeship, 19 years for individuals with secondary education and apprenticeship, 20 years for individuals with Abitur and no apprenticeship, 22 years for individuals with Abitur and apprenticeship, 27 years for individuals with technical college degree and 28 years for individuals with university degree. Individuals with an experience of more than 35 years are dropped, because the propensity of labour market exit increases for older employees, and natives and foreign employees differ strongly in this regard (Bonin 2005: 8).

[9] Working experience is divided into following triennial intervals: 0-2, 3-5, 6-8, 9-11, 12-14, 15-17, 18-20, 21-23, 24-26, 27-29, 30-32 and 33-35 years.

[10] For example groups Bonin (2005) all individuals without apprenticeship into one educational category irrespective of their highest school degree although it has a significant impact on labor market outcomes.

The occupational groups are constructed by using the occupation and labour market experience as grouping criteria. The advantage of the occupation variable in the employment sample is that it describes the actual job of an employee instead of just formal vocational qualification. This already accounts for the possibility that the real occupation does not match the official occupational qualification for different reasons. As a first step all occupations are classified into 22 fields in principle following the system of the IAB (2008). In all cases the allocation to the particular categories depends upon similarities concerning job characteristics, the material used, environment or general job requirements.[11] In the second step these occupational fields are classified into three basic categories: To the first category belong all occupations essentially in manufacturing. This includes jobs related to the manufacturing and production of goods or raw materials and occupations that are connected to the use of plant and machinery. The second class are jobs in primary services. Occupations in this category are related to trade, office work, cleaning, handling and storing. The third category includes secondary service occupations including jobs related to research & development, organisation, management, consultancy, teaching and health care.

In the third step, we implemented a finer classification by dividing each occupational category into basic and advanced jobs. The classification should ensure that workers across occupational groups are imperfect substitutes. It also accounts for a certain mobility within occupational categories, but excludes job changes across segments with huge differences in job requirements. As an example it is assumed that a welder can replace a metal worker, but not a teacher. The labour market experience is approximated in the described way and scaled into intervals of 3 years.[12] By the combination of b=1,..3 respectively 1,…6 occupational categories and a=1,..12 intervals of work experience, 36 respectively 72 occupational groups are constructed. Subsequently the structure of the data is transformed into a balanced panel by connection of the repeated cross-sections with the variables *year* and *skill /occupational group.*

The individual values are then used to calculate averages of the wages and foreigner shares per skill/occupational group. The status of an immigrant is exclusively defined by nationality.

[11] The used classification differs in so far as we classify occupations into 22 instead of 20 fields. This is done to ensure that all occupational fields can be distinctly allocated to one occupational category (manufacturing, primary and secondary services).
[12] To the knowledge of the author, there is no German data base providing any information about the average age of labor market entry by occupations.

The IAB data do not allow us to identify immigrants of the second generation who will be counted as foreigners if they posses a foreign passport even if they are born in Germany. In addition to this, the foreigner share in the IABS does not capture naturalized immigrants or Aussiedler (Steinhardt 2008). For this reason, the observed foreigner share may under- or overvalue the real stock of immigrants. Because of the fact that in the IABS wages are only displayed up to the contribution limit of the social insurance, the problem of biased estimates occurs. To avoid this problem a two-step procedure based on the approach of Gartner (2005) is implemented to impute the censored wages.[13] The Euro is selected as uniform currency. Furthermore all wages are deflated by using the consumer price index of the former federal territory on the basis 1995.[14] For the estimation of the wage effect of immigration the dependent variables $\ln w_{it}$ and $\ln w_{ot}$ are generated, which describe the average daily wage in logarithms of the German employees by skill and occupational group per year. The prepared dataset contains 1,944 (skill groups) or 972/1,944 (occupational groups) observations during the period 1975 to 2001, which represent 4,498,461 individual notifications.

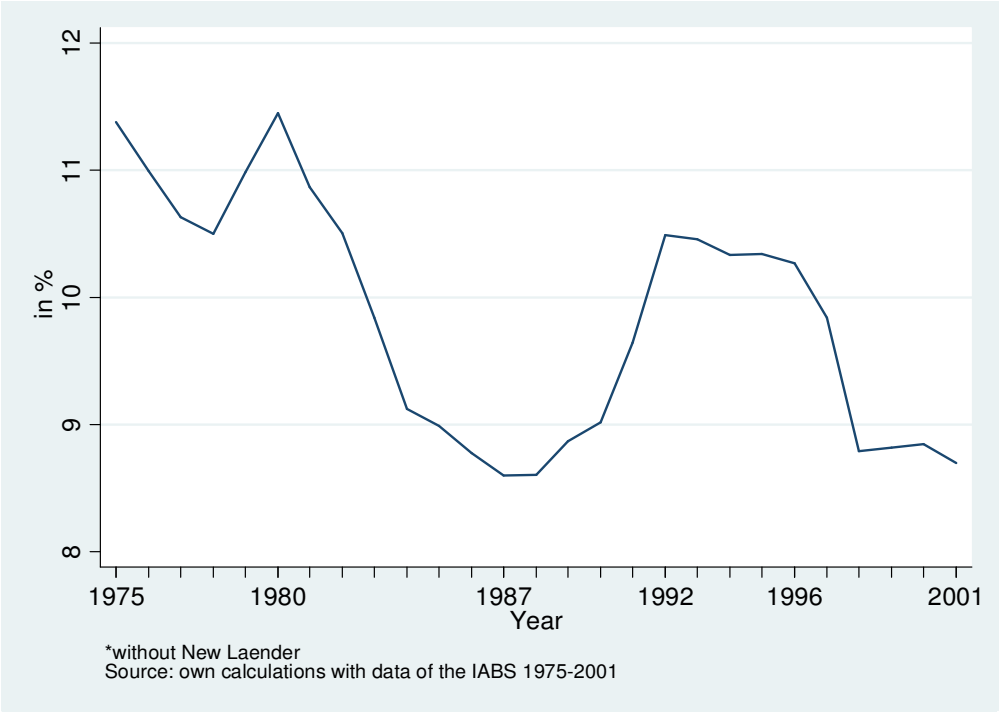
[13] In a first step the wage was estimated by a tobit-regression. The dependent variables were, among others, occupation, occupational status, education and economic sector. In a second step the censored wages were imputed by taking drawings from the estimated truncated distribution.

[14] The exact name of the used consumer price index is: „Preisindex für die Lebenshaltung aller privaten Haushalte für das frühere Bundesgebiet auf Basis 1995“and is provided by the Federal Statistical Office of Germany.

5 Descriptive results

Diagram 1 shows the annual share of employed foreigners in the overall employment covered by social security. It becomes obvious that the employment share of foreigners was subject to considerable fluctuations, which corresponds to changing immigration patterns to Germany during this period. The most prominent and sustainable inflow of migrant workers from Southern European and North African countries took place during the so-called guest-worker era from the mid 1950s until the recruitment ban in 1973. In the first years after the ban and in the first half of the 1980s Germany experienced a negative migration balance due the dwindling inflow from labour exporting countries and a state- assisted remigration of guest workers. This outflow of foreigners is already partly reflected in the decline of the share of foreign employees from 1975 to 1980, but is especially noticeable in the period 1981 to 1986.

Diagram 1: Foreigner share in overall employment in Germany 1975-2001



During the following years Germany recorded a strong inflow of east European migrants, asylum seekers, war refugees from former Yugoslavia and through family reunification agreements. A special group were asylum seekers, which began to rapidly increase with German unification. As a reaction to this, Germany changed the asylum law after controversial political discussions and restricted acceptance and entry of asylum seekers,

which is the main reason for the decline in net migration after 1993. During the years 1993 to 1996 the share of foreign employees remained almost constant. While the period 1997 - 2001 was characterized by a slight positive net migration, the employment share of foreigners declined. This could be explained by remigration and rising unemployment. The denoted trends in immigration and employment of foreign employees will be taken up in the empirical analysis to estimate the effect of immigration for selected periods.

Some descriptive statistics will shed more light on the age, educational and occupational structure of both native and foreign employees included in the sample. Table 1 shows that foreign employees are on average younger than native employees. This relation applies for all periods. Furthermore the data exhibits huge disparities between both groups concerning the qualification structure. The share of employees without apprenticeship is more than three times higher for the group of foreigners compared to natives. Accordingly the share of university graduates is considerably higher within the group of German employees, although the discrepancy between the groups is lower in this education category. Furthermore it becomes obvious for both groups that the qualification structure improves over time: The share of employees with university degrees increases while the share of employees without vocational education declines over time. Concerning the latter, some convergence between natives and foreigners can be observed.

The lower part of the table shows the distribution of native and foreign employees on the basis of three basic occupational categories. The figures demonstrate huge disparities between foreigners and natives in the occupational distribution. While only about 50% of the German employees have an occupation related to manufacturing, 70% of all foreign employees have a job in manufacturing. In addition, the table exhibits an occupational shift from manufacturing to service related jobs. This is in line with the on-going structural change towards a service economy in Germany during the last decades. It is worth noting that between 1975 and 2001 the foreigner share in primary service occupations increased by almost 10 percentage points.

Table 1: Descriptive Statistics- Native and foreign employees

	1975-2001	75-80	81-86	87-92	93-97	97-01
Age						
Natives	36.95	35.48	36.40	37.00	37.83	38.58
Foreigner	35.84	34.44	36.24	36.59	36.07	36.13
Education						
Without apprenticeship (in %)						
Natives	14.94	19.71	16.57	16.57	11.80	11.35
Foreigners	55.83	63.59	59.92	54.37	49.51	47.10
With university degree (in %)						
Natives	4.85	2.55	3.66	4.96	6.20	7.77
Foreigners	3.03	2.16	2.81	3.28	3.32	4.00
Occupations						
Manufacturing oriented occupations (in %)						
Natives	47.14	51.69	49.10	46.93	44.14	42.16
Foreigners	70.35	76.23	73.07	69.47	65.99	63.52
Primary service occupations (in %)						
Natives	33.31	32.11	32.62	33.11	34.15	35.14
Foreigners	22.24	18.32	19.92	22.38	25.52	27.71
Secondary services occupations (in %)						
Natives	19.55	16.20	18.28	19.97	21.71	22.69
Foreigners	7.41	5.44	7.01	8.15	8.49	8.77
N (Average/ Year)	166,995	161,487	164,519	177,120	171,370	159,508

rounded to 2 decimal place
The figures are derived from the individual data after the documented preparation steps.
own calculations with data of the IABS 1975-2001

The indication that the occupational concentration of natives and foreigners with similar education might differ is revealed by the diagrams 2 and 3 which display the occupational distribution of both groups by educational categories.[15] While 57% of all native employees with primary education work in manufacturing jobs, almost 73% of the similar educated foreigners are concentrated in manufacturing. But more striking is that the same holds true for the employees with secondary education: here are 70% of the immigrants employed in manufacturing, relative to 51% of the natives. The occupational distribution in the two higher educational categories is more similar between the two groups. The figures therefore are in line with the empirical findings for the Spain and US (Amuedo-Dorantes and de la Rica (2008), Peri and Sperber (2009)): Immigrants tend to be highly represented in jobs with manual tasks as opposed to service jobs that require interaction and communicative skills.

[15] The occupational fields correspond with the basic occupational categories in table 1. Education was classified by grouping employees with Abitur and apprenticeship together with employees with Abitur and no apprenticeship, and employees with technical college together with university graduates. The uneven occupational distribution holds true if it is accounted for labour market experience (see table A1 in the appendix for an example of the occupational distribution of employees with primary education across experience cells).

Diagram 2: Occupational distribution by education: Natives

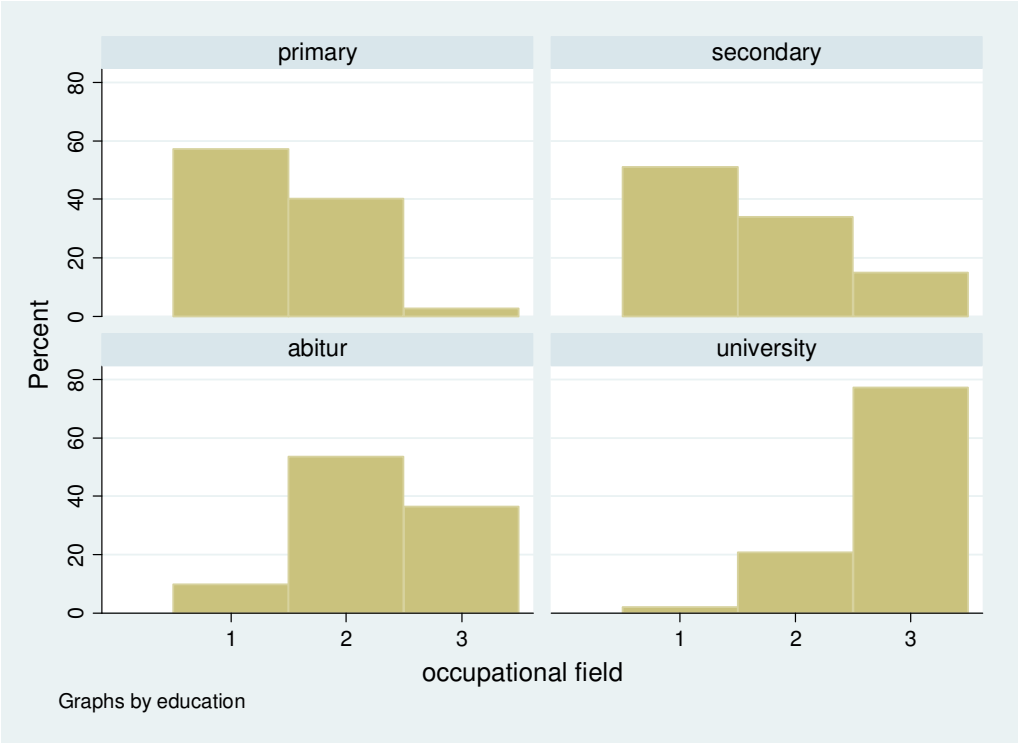


Diagram 3: Occupational distribution by education: Foreigners

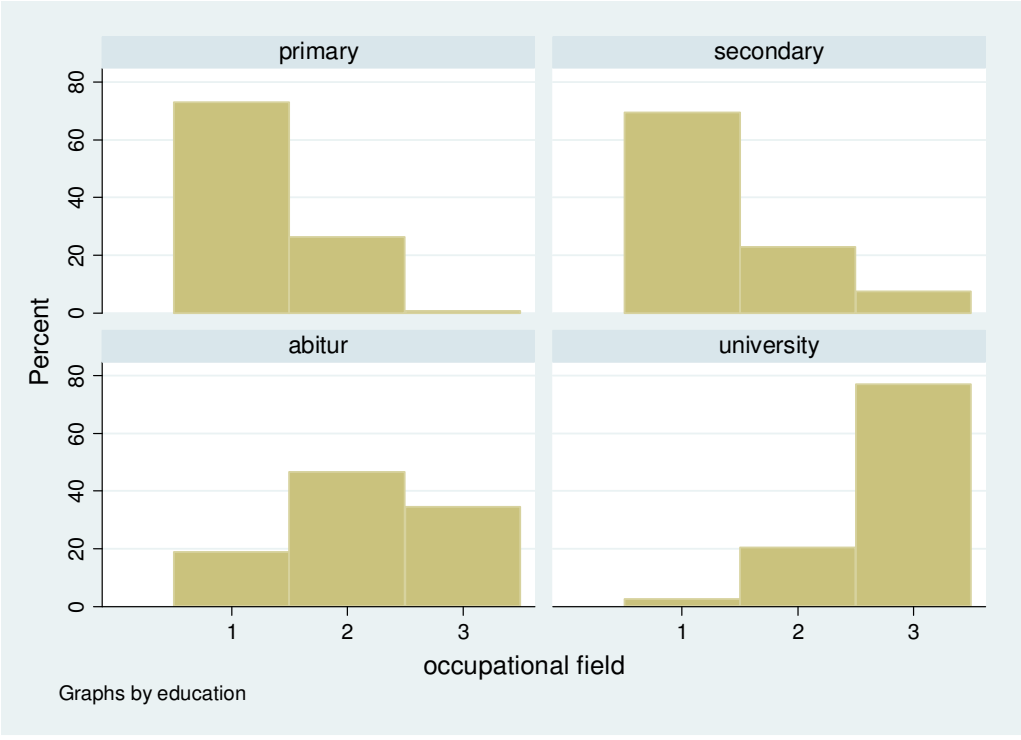


Table 2 contains the means and standard errors of the wage itemised by selected periods and nationality. Considering the mean of the deflated daily wage in the upper part of the table, the impact of the imputation of the censored wages on the level of the average wage was slight. It becomes obvious that the average wage of native employees is higher than the wage of foreign employees. This corresponds to the lower qualification and occupational profile of immigrant employees.

Table 2: Wages- means and standard errors

	75-01	**75-80**	**81-86**	**87-92**	**93-96**	**97-01**
Average Wages	79.62	68.48	73.86	83.15	87.34	88.89
	(24.61)	(17.09)	(20.66)	(24.28)	(25.85)	(28.20)
Average wages after	79.78	68.63	74.05	83.36	87.47	89.04
imputation:	(24.85)	(18.18)	(21.00)	(24.58)	(26.01)	(28.40)
By Nationality:						
Natives	80.77	69.24	74.71	84.18	88.96	90.44
	(25.02)	(18.40)	(21.22)	(24.70)	(25.84)	(28.28)
Foreigners	70.74	63.73	68.01	75.21	74.57	74.89
	(21.18)	(15.45)	(17.70)	(21.68)	(23.79)	(25.81)

rounded to 2 decimal place
own calculations with data of the IABS 1975-2001

6 Empirical Results

6.1 Skill Groups

Initially, the impact of immigration on native wages is analyzed on the basis of skill groups. A *Breusch-Pagan Lagrangian Multiplier Test* shows that a model should be selected controlling for unobserved heterogeneity (Wooldridge 2002: 264-265). Generally two model types for estimating panel data with unobserved heterogeneity are possible: the fixed-effects model and the random-effects model. The choice of the model depends on whether the independent variables are correlated with the individual error term (Wooldridge 2002, pp. 251-252). A *Hausman Test* showed that the time-constant error term is correlated with the central independent variable and therefore supports the use of a fixed-effects model.[16] Robust standard errors to autocorrelation and heteroskedasticity were estimated by correcting for

[16] The corresponding test statistics are in table A2.

clustering into skill groups (Borjas 2003: 14, Bonin 2005: 11, Petersen 2009).[17] The regressions were weighted, whereas the annual number of native employees within a skill group was used as a weight. Table 3 reports in addition to the estimated coefficient of the foreigner share the coefficients of education and work experience for the all skill groups over the whole observation period.[18]

Table 3: Wage effects of migration/skill groups

Dependent variable:	**ln w_{it}**
Foreigner share	-0.059** (0,025)
Education	
secondary education and apprenticeship	0.188***(0.010)
Abitur without apprenticeship	0.136***(0.025)
Abitur with apprenticeship	0.317***(0.029)
technical college degree	0.740***(0.037)
University degree	0.782***(0.040)
Labour market experience in years	
3-5	0.376***(0.016)
6-8	0.504***(0.017)
9-11	0.562***(0.017)
12-14	0.599***(0.017)
15-17	0.609***(0.016)
18-20	0.606***(0.018)
21-23	0.603***(0.016)
24-26	0.596***(0.017)
27-29	0.598***(0.016)
30-32	0.601***(0.016)
33-35	0.596***(0.016)
Lagged Variable	No
Time effects	Yes
Interaction effects	Yes
Number of Observations	1944
R^2	0.9965

Standard errors in parentheses robust to autocorrelation and heteroskedasticity
***significant at 1% level, ** significant at 5% level
rounded to 3 decimal place
reference categories: Without apprenticeship, labour market experience 0-3 years
own calculations with data of the IABS 1975-2001

[17] A Wooldridge-test shows that the assumption of uncorrelated error terms has to be rejected (Wooldridge 2002: 282-283). A *Breusch-Pagan/ Cook-Weisberg Test* has the result that the data suffer from heteroskedasticity. Both test statistics are to also be found in A3.

[18] We observe 72 Skill Groups over the period of 27 years. The coefficients of the interaction terms are not presented, because this would go beyond the scope of the paper and is furthermore not of interest. The inclusion of the interaction terms serves only for control purposes.

All coefficients are significant and all, with the exception of the migration variables, take a positive sign. [19] The result that education and experience have a positive impact on wages is not surprisingly. While the impact of education increases by level of education, the positive impact of work experience declines from a certain range (20 years). The impact of the foreigner share on native wages is negative, but the size of the effect is relatively small. Following Borjas (2008) the estimated adjustment coefficient can be converted into an elasticity giving the percent change in foreign employment to percent change in native wages:

$$\varepsilon_{w/x} = \frac{\partial \ln w_{it}}{\partial x_{it}} = (1 - m_{it})^2 * \alpha_1 \quad (3)$$

where x_{it} describes the percentage increase in labour supply through immigration ($x_{it} = M_{it}/N_{it)}$. The wage elasticity, evaluated at the mean value of the immigrant share within skill groups (10%), is then -0.0478 with a standard error of 0.020. This means that an inflow of immigrants increasing the number of employees in a skill group by 10 percent reduces native wages by 0.48%.[20] The estimated adjustment coefficient of Bonin (2005) who also adopts the approach of Borjas (2003) and uses the earlier version of the IAB employment sample (1975 - 1997) is more than twice as big as the coefficient here. This may be due to differences in the dataset and the construction of the skill groups. However, both estimated effects are relatively small compared the estimated impact in Borjas (2003) for the US (10 percent increase in employment through immigration reduces native annual earnings by 6.4%).

Table 4 contains various specifications of the basic estimation to test the robustness of the results. At first, the log native workforce was included as a control variable. This refers to the problem that an increase in the foreigner share within a skill group, which is used as a proxy for immigration, can either be caused by a positive change of the number of foreign workers or by a decrease of the native workforce. The latter can happen through cohort effects in educational attainment (Borjas 2003: 1350, Bonin 2005:12). Since the coefficient remains stable and significant the coefficient m_{it} is not driven by changes in the employment of natives. The second row reports the result of the regression including all employees with unknown qualification while assigning them to the lowest educational category. As a result the coefficient becomes insignificant. This is not surprising since some individuals with

[19] The coefficient of determination shows a very high value. This is a characteristic of LSDV regressions. In the present case a high share of the variation in the data can be explained by the dummies for years, skill groups and their interactions (Wooldridge 2006, p. 490).

[20] Alternatively the coefficient can be interpreted as semi-elasticity since the wages are in logarithms: An increase of the foreigner share within a skill group by one percentage point leads to a decline in native wages by 0.059%.

unknown education will have a vocational or university degree and will bias the result if they are assigned into the lowest education category. Eventually the classification of the skill groups was modified influencing the number of observations. While the results are roughly similar if the employees are assigned into 2-years-experience cells, the results become insignificant when the regression are conducted on the basis of a broader classification of skill groups related to experience. In the case of a broader educational classification, using 4 instead of 6 educational categories, the coefficient increases. This is a reasonable result since the new grouping increases the relative weight of the lower educational groups which have been stronger affected by immigration. Last but not least the table shows that the results are not driven by skill groups with a minor number of observations.

Table 4: Tests of robustness

1975-2001	Foreigner share	
Log Native Workforce as additional independent variable	-0.053**	(0.023)
Inclusion of employees with unknown education	-0.017	(0.022)
Alternative classification of skill groups:		
4 educational categories; N=972	-0.102***	(0.013)
2 years intervals of experience; N=2914	-0.064***	(0.018)
4 years intervals of experience; N=1458	-0.045	(0.032)
Minimum number of observations		
Min 500 observations/skill group/year; N=1076	-0.075***	(0.022)
Min 1000 observations/skill group/year; N=713	-0.080***	(0.022)

Standard errors in parentheses robust to autocorrelation and heteroskedasticity
***significant at 1% level, **significant at 5% level
rounded to 3 decimal place
own calculations with data of the IABS 1975-2001

Table 5 shows the estimations by education categories and selected periods. Looking at the estimates in the second column shows that the slight impact for the whole observation period is associated with the fact that the relationship between immigration and wages is not always significantly negative. In this context the question occurs whether low and high qualified native employees are affected in the same way. The second and third columns contain the coefficients for native employees with low and high education.[21]

[21] To obtain samples with sufficient size the following classification was made: employees without apprenticeship, secondary education and apprenticeship and with Abitur and no apprenticeship were defined as individuals with low education. Employees with Abitur and apprenticeship, technical college degree and university degree are defined as individuals with high education.

Table 5: Estimation by education categories and selected periods/wage effect

Dependent variable: log average daily wages of native employees within a skill group						
Foreigner Share:	Overall		Low education		High education	
1975-2001	-0.059**	(0,025)	-0.089***	(0.014)	0.066	(0.081)
1975-1980	-0.088	(0.073)	-0.165**	(0.0797)	0.070	(0.169)
1981-1986	-0.060	(0.061)	-0.077	(0.074)	-0.109	(0.141)
1987-1992	-0.106**	(0.052)	-0.176***	(0.051)	0.038	(0.180)
1993-1996	-0.018	(0.048)	-0.002	(0.058)	-0.114	(0.168)
1997-2001	0.0485	(0.089)	-0.011	(0.115)	0.134	(0.164)

Standard errors in parentheses robust to autocorrelation and heteroskedasticity
*** significant at 1% level, **significant at 5% level, *significant at 10% level
rounded to 3 decimal place
own calculations with data of the IABS 1975-2001

While the estimates point to a clear and significant, negative impact of immigration within the group of low educated employees, there is no empirical evidence for a negative wage impact on high skilled labour. Furthermore, the significance and the size of the wage impact of native low educated employees differ during the several periods of immigration. The results show that only in the periods 1975 -1980 and 1988 - 1992 the relationship between the share of foreigners and native wages was significantly negative. The size of the immigration impact in these periods is more than twice the aggregate impact. It becomes obvious that the results are mainly driven by a strong negative correlation within the group of low skilled employees indicating a high elasticity of substitution between natives and foreigners with low skills.

In contrast, the correlation between the foreigner share and wages of native employees with high education was positive during these periods, but insignificant. This result may be expected because migration to Germany was mainly characterized by the inflow of workers with low qualifications (Velling 1995: 40). In addition to this it is a reasonable result, that the degree of substitution between foreigners and natives varies with the level of skills since the substitutability of low skilled employees is higher and training costs are lower compared to skilled workers (Orrenous and Zavodny 2007: 759-760).

The small estimated wage effects of immigration could be caused by the fact that the German labour market absorbed the inflow of immigrant workers by an increase of unemployment. For this reason an additional estimation was conducted to analyse the impact of immigration on the unemployment of natives based on equation (1) using the unemployment rate of natives within a skill group as the dependent variable. However, though this yields a significant positive coefficient, the effect is small. An increase in the foreigner share within a

skill group by one percentage point causes a rise in native unemployment by 0.072 percentage points.[22]

6.2 Occupational groups

Since the descriptive analysis has indicated that foreigners and natives with comparable qualifications in Germany are likely to work in different occupational segments one crucial assumption of the skill group approach seems to be violated. For this reason it seems reasonable to complement the analysis by estimating the wage impact of immigration on the basis of occupations. Table 6 exhibits the results of the estimates of the impact of immigration on the basis of occupational groups by using equation (2).[23] The coefficient of the foreigner share is negative and has three times the size of the estimate for skill groups, however it is less significant. By using equation (3) the corresponding wage elasticity, calculated at the mean value of the immigrant share in occupational groups (8.4%), is -0.159 with a standard error of 0.086. A 10% increase in labour supply through immigrants in an occupational group reduces native wages by 1.59%. This result suggests that the low impact of migration on the level of skill groups might be caused by the fact that foreigners and immigrants with equal qualifications work in different occupational segments. All other coefficients are positive and highly significant. Since the reference categories for occupational segments are manufacturing jobs, the positive sign of the other occupational coefficients is plausible. As for the classical skill group approach the positive impact of experience increases in general with the years.

[22] In contrast to the wage, the unemployment rate is not in logarithms. The calculated unemployment rates differ strongly from the official unemployment rates in Germany due to the fact that the IABS-r01 includes only employees that are covered by social security. Therefore only a subgroup of the overall workforce enters the sample. In addition to this, persons that exhibit exclusively periods of benefit payments are not included at the drawing of the sample. In the period of 1975-1980 benefit recipients are less represented, than they should have been related to the entire population. For this reason these years were not included in the estimation of the unemployment effect of immigration.

[23] Corresponding test statistics in A4 and A5.

Table 6: Wage effects of migration/occupational groups

Dependent variable: ln w_{ot}		
Foreigner share	-0.189*	(0.103)
Occupational fields		
Primary service occupations	0.082***	(0.015)
Secondary service occupations	0.489***	(0.022)
Labour market experience in years		
3-5	0.380***	(0.030)
6-8	0.473***	(0.032)
9-11	0.530***	(0.035)
12-14	0.567***	(0.036)
15-17	0.568***	(0.034)
18-20	0.557***	(0.034)
21-23	0.553***	(0.033)
24-26	0.548***	(0.033)
27-29	0.538***	(0.032)
30-32	0.532***	(0.032)
33-35	0.525***	(0.034)
Time effects	Yes	
Interaction effects	Yes	
Number of Observations	972	
R^2	0.9951	

Standard errors in parentheses robust to autocorrelation and heteroskedasticity
***significant at 1% level, *significant at 10% level
rounded to 3 decimal place
reference categories: manufacturing jobs, labour markets experience 0-3 years
own calculations with data of the IABS 1975-2001

Table 7 contains a number of additional specifications to check the robustness of the results. As first the log native workforce was included as a control variable. Since the coefficient remains stable and significant the coefficient m_{it} is indeed capturing the impact of an increase in the size of the foreign workforce within occupation-experience cells on native wages. It furthermore becomes obvious that the results are not driven by occupational groups with a small number of observations. As a further robustness check we modified the classification of the occupational groups: When using the described 6-digit occupational classification the results stay significant, however the size of the coefficient is reduced. In the case of using the occupational classification provided by the IAB (20 digit occupations) and intervals of 9 years experience the coefficient decreases and loses its significance. However, this classification produces many occupation-experience cells with few observations and is therefore sensitive to outliers.

Table 7: Tests of robustness

1975-2001	Foreigner share	
Log Native Workforce as additional independent variable	-0.196*	(0.102)
Minimum number of observations		
Min 1000 observations/occupational group/year; N=970	-0.190*	(0.103)
Alternative classification of occupational groups		
6 occupational categories N=1944	-0.128*	(0.069)
22 occup. categories, 9 year intervals of experience; N=2376	-0.051	(0.046)

Standard errors in parentheses robust to autocorrelation and heteroskedasticity
*significant at 10% level
rounded to 3 decimal place
own calculations with data of the IABS 1975-2001

The estimates in Table 8 enable a more detailed analysis of this issue by differentiating the impact by periods and the basic occupational categories.[24] It becomes obvious that immigration had a significant negative impact on native wages in occupations related to primary services. The estimated adjustment coefficient is -0.0466 and highly significant. The corresponding wage elasticity is -0.394 with a standard error 0.079.[25] This means that an inflow of immigrants within an occupational group related to primary services which increases labour supply by 10 percent reduces native wages by 3.94%. The magnitude of impact is remarkable and comparable to the ones found for the US by Borjas (2003).

Table 8: wage effects of immigration/ occupational groups

	Overall		Manufacturing		Primary service		Secondary service	
1975-2001	-0.128*	(0.069)	-0.103	(0.076)	-0.466***	(0.094)	-0.145	(0.297)
1975-1980	-0.158	(0.096)	-0.091	(0.103)	-0.384**	(0.152)	-0.283	(0.247)
1981-1986	-0.088	(0.076)	-0.010	(0.088)	-0.283	(0.181)	-0.051	(0.185)
1987-1992	-0.112	(0.119)	0.018	(0.185)	-0.622***	(0.160)	-0.118	(0.592)
1993-1996	-0.138	(0.110)	-0.159	(0.149)	-0.217	(0.155)	-0.716	(0.464)
1997-2001	0.039	(0.146)	0.231	(0.139)	0.377*	(0.209)	-0.253	(0.532)

Standard errors in parentheses robust to autocorrelation and heteroskedasticity
***significant at 1% level, **significant at 5% level, *significant at 10% level
rounded to 3 decimal place
own calculations with data of the IABS 1975-2001

[24] The estimates are based on the 6-digit occupational classification.
[25] See equation (3). Elasticity is calculated at the mean immigrant share within primary service occupations (8.0%). The estimates are robust to an inclusion of the native workforce, the exclusion of occupational groups with less than 1000 observations and alternative classifications of the occupational groups.

The results are, mainly driven by the periods 1975-80 and 1987-1992, while especially the latter period was characterized by a strong increase in foreign employment. The same holds true for the estimates for low educated employees in table 5. The result that immigration in the 90s had no significant negative - or even a positive impact - on native wages corresponds as well with the estimates on the level of skill groups and findings of D`Amuri et al. (2009). One explanation for the strong impact within primary service occupations may be relative low presence of organised labour. While jobs related to manufacturing like mining or metal works have mainly rigid wages due to a high union density, the service sector is characterized by a lower rate of unionization making wages more flexible.

6.3 Additional Instrumental Variable Approach

Last but not least, the question arises whether the estimates for occupations might be biased by induced migration and endogeneity of the occupational choice of immigrants. The first term refers to a situation in which natives change their occupation as a response to immigration which would disperse the wage effect across occupations. However, this should not be a problem in the short run since the occupational choice of an individual is in general more restricted than a location decision (Friedberg 2001). While an employee easily can change his location and work within his profession, it might be more difficult to change his occupation since this is in most cases related to vocational training.

Concerning potential endogeneity bias the picture is more mixed: On the one hand, it is reasonable to assume that the occupational choice of immigrants will be influenced by wages. If immigrants choose occupations with higher wages the immigration impact will be underestimated. On the other hand indicate recent studies that immigrants in the short run are not able to choose their occupation freely, and are channelled into occupations of significantly lower status than natives ((Friedberg 2001, Constant and Massey 2005). In this case the impact of immigration on native wages might be overestimated. For this reason the size and the direction of the endogeneity bias is not as straightforward as within the geographic framework. However, we decided to use an Instrumental Variable Approach (IV) to correct for possible endogeneity.[26]

[26] Although our adjustment coefficient measures changes in foreign employment on wage growth within occupation-experience cells over time our results can suffer from endogeneity if occupational choice depends not only on wages, but also on wage growth.

Since we had no information on the immigrant's previous occupational distribution like Friedberg (2001) we decided to rely on lags of the immigration share within occupational groups. The underlying idea is that new immigrants are likely to work in occupations which are already characterized by a high share of foreign employees due to ethnic networks. Empirical evidence for the US reveals that new arriving immigrants are likely to locate in the same occupations like their ethnic relatives already residing in the country (Patel and Vella 2007). The previous occupational distribution of immigrants however should be uncorrelated with actual economic conditions. A similar approach is used by Dustmann et al. (2005) who use measures of historic settlement patterns as instruments for spatial immigrant inflows. Table 9 provides the results of a difference-in difference estimation and GMM-IV approach using the lagged immigrants share as an instrument.[27]

Table 9: Difference-in-Difference and GMM-IV

Diff-in-Diff, independent variable m_{it}	-0.118**	(0.057)
GMM-IV Estimation 1st stage, independent variable m_{it-1}	0.265***	0.035
GMM-IV Estimation 2nd stage, m_{it} instrumented with m_{it-1}	-0.251**	(0.112)
Endogeneity Test	Chi-sq(1) = 3.028	P-val = 0.082
Value of F Statistic (for instrument)	F(1,1374) = 55.50	Prob>F = 0.000
Anderson canon. corr. LR statistic	Chi-sq(1) =135.63	P-val = 0.000

Standard errors in parentheses robust to autocorrelation and heteroskedasticity
*** significant at 1% level, **significant at 5% level
rounded to 3 decimal place
own calculations with data of the IABS 1975-2001

The first-stage results reported in the second line suggest that the selected instrument is not weak. This is confirmed by the value of the F-statistic and the Anderson LR test statistic. The endogeneity test has been performed under the null hypothesis that the foreigner share within an occupation-experience cell can actually be treated as exogenous. This can be rejected at the 10% level. The results of the second stage imply that a 10% increase in the workforce within an occupational group through immigration reduces native wages by 2.65%. The contrast to the results of the OLS Difference-in-Difference estimation indicates that endogeneity might play a role for the analysis in the way that immigrants tend to choose occupations with favourable economic conditions. The Instrumental Variable Approach therefore strengthens

[27] We apply the GMM estimation method since we have already shown that heteroscedasticity is commonly present (see A5). The estimations were conducted by using the Stata[tm] module xtivreg2 developed by Schaffer (2005).

the result that immigration has a significant impact on wages and indicates that the OLS results might be interpreted as a lower bound of the real impact.

7 Conclusions

The empirical analysis on the level of skill groups has shown that immigration has only a small negative effect on the wages and the employment of the native workforce in Germany. An inflow of immigrants increasing the number of employees in education-experience cell by 10 percent reduces native wages by 0.48%. The wages of employees with low education are disproportionately highly affected by the inflow of foreign workers. This result is not surprising when considering the fact that immigration to Germany was mainly influenced by an inflow of unskilled guest workers. Furthermore, it is reasonable that the substitutability of foreign and native employees decreases with the level of qualification. However, even the impact for low skilled natives is comparatively low. This may be caused by the fact that foreigners and immigrants with equal qualifications are likely to work in different occupational segments.

For this reason the analysis was extended to the level of occupations. The results now indicate that 10% supply increase through immigration reduces native wages by 1.59% within an occupational group. In addition to this, the analysis highlights that especially employees with basic service occupations were negatively affected by immigration. Within these occupational groups a 10 percent increase in the workforce through immigration causes a reduction in native wages by 3.94%. This confirms that natives and foreigners in the labour market segment for basic services like cleaning or retail trade are characterized by a high elasticity of substitution.

The results on the occupational level have demonstrated that the use of formal qualifications as an exclusive classification criterion may lead to an underestimation of the impact of immigration. This especially holds true for the German labour market which is characterized by a high relevance of formal qualifications and a number of institutional regulations concerning the employment of foreigners. In addition to this, the reliability of the education variable for immigrants in most German data sets is relative low. The high impact for employees with primary occupations emphasises the necessity for future studies to model the institutional and socioeconomic differences between immigrants and natives beyond formal education.

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Appendix

A1: Occupational distribution of natives and immigrants with primary education (in %)

Years of Experience	Nationality	Manufacturing	Primary Services	Secondary Services
0-2	German	66.85	31.86	1.29
	Foreigner	70.01	29.65	0.34
3-5	German	63.12	35.23	1.65
	Foreigner	69.81	29.6	0.59
6-8	German	60.24	37.97	1.79
	Foreigner	70.98	28.46	0.56
9-11	German	58.39	39.56	2.05
	Foreigner	71.4	28	0.61
12-14	German	57.35	40.37	2.28
	Foreigner	72.04	27.17	0.8
15-17	German	56.46	41.01	2.53
	Foreigner	73.61	25.61	0.78
18-20	German	55.83	41.43	2.73
	Foreigner	74.26	24.93	0.81
21-23	German	55.8	41.3	2.91
	Foreigner	74.24	24.94	0.82
24-26	German	55.64	41.41	2.95
	Foreigner	74.23	24.85	0.91
27-29	German	55.51	41.33	3.16
	Foreigner	74.05	25.15	0.8
30-32	German	55.04	41.62	3.34
	Foreigner	73.7	25.51	0.79
33-35	German	54.39	42.05	3.57
	Foreigner	72.56	26.66	0.77

A2: Test statistics panel analysis/ skill groups

Breusch-Pagan LM test	chi2(1) = 23.49	Prob > chi2 = 0.0000
Hausman test	chi2(1) = 118,41	Prob>chi2 = 0.0000
Joint Significance test	F(71, 1429) = 229.30	Prob > F = 0.0000

A3: test autocorrelation and heteroskedasticity / skill groups

Wooldridge test	F(1,71) = 21.049	Prob > F = 0.0000
Breusch-Pagan/Cook-Weisberg test	chi2(1) = 734.98	Prob > chi2 = 0.0000

A 4: Test statistics panel analysis/ occupational groups

Breusch-Pagan LM test	chi2(1) = 18.69	Prob > chi2 = 0,0000
Hausman test	chi2(1) = 75.72	Prob>chi2 = 0.0000
Joint Significance test	F(34, 571) = 197.13	Prob > F = 0.0000

A5: test autocorrelation and heteroskedasticity / occupational groups

Wooldridge test	F(1, 35) = 217.035	Prob > F = 0.0000
Breusch-Pagan/Cook-Weisberg test	chi2(1) = 44.91	Prob > chi2 = 0.0000

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Hamburg Institute of International Economics (HWWI)

Heimhuder Str. 71 | 20148 Hamburg | Germany
Phone +49 (0)40 34 05 76 - 0 | Fax +49 (0)40 34 05 76 - 776
info@hwwi.org | www.hwwi.org