

## WAGE ASSIMILATION OF FOREIGNERS: WHICH FACTORS CLOSE THE GAP? EVIDENCE FROM GERMANY

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This study analyzes the development of the wages of male foreign workers from all important sending countries across time using longitudinal employment register data. A cohort analysis of the individuals entering the German labor market in the years 1999 to 2001 indicates that the raw wage gap of migrants compared to native Germans decreases by 14 log percentage points in the first eight years. The results of a decomposition method based on fixed effects regression models give evidence that this wage adjustment is mostly due to time-varying observable characteristics. Selective return migration, and the trend effects play no role for the aggregate. We find that wage assimilation happens mainly through three channels: first, through the accumulation of firm-specific human capital, which explains approximately 40 percent; second, search gains are approximately the same order of magnitude; and third, the accumulation of general human capital explains one-fifth of the assimilation. We further demonstrate that the importance of these channels differs substantially by the origin groups.

**JEL Codes:** J15, J31, J61

**Keywords:** economic assimilation, foreigner-native earnings inequality, immigration

### 1. INTRODUCTION

The integration of foreign workers into the labor markets of host countries is a major concern of (immigration) policy, as their contribution to the national economy of the host country depends directly on their success in the labor market. Although general notions of assimilation embrace social and cultural aspects, income and wages clearly constitute important prerequisites to assimilation along with the other dimensions. Since Chiswick's (1978) seminal contribution for the U.S., it is widely recognized in the empirical literature (see Pekkala Kerr and Kerr, 2011, for an excellent survey of the economic impacts of immigration) that foreigners typically earn less than natives when entering the labor market of the host country but that they catch up with the wages of natives in their later working life, at least to some extent.

In the standard approach (as discussed by Borjas, 1999), assimilation is measured by the coefficient of experience acquired in the host country (frequently proxied by the years since migration). Other characteristics, for example education, tenure, and industry and occupation dummies, are considered rather as a

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nuisance that has to be controlled for to isolate the partial effect of the host country experience. The latter effect depends therefore strongly on the inclusion or exclusion of the control variables. While this approach simplifies communication and policy advising by condensing all results into one number, it tends to neglect the multi-dimensional nature of assimilation and therefore produces an all-embracing but possibly oversimplified picture of assimilation. This contrasts with the modern labor market theories that put the focus on several other important contributions to wage growth, for example on the search and matching gains. Search gains may be particularly important for the foreigners who clearly lack market and search experience at the time of entry and therefore feel compelled to take the first job that comes along to gain a foothold in the host country. Improved language skills will not only raise their labor productivity but also enable them to understand the local labor market conditions and find better employment matches. Although a great deal of the empirical research in the economics of immigration has made attempts to measure the catch-up rate, surprisingly few studies have aimed to measure the importance of the different channels of wage assimilation. Notable exceptions are Eckstein and Weiss (2004) and Damas de Matos (2011). We will comment on them below.

To broaden the narrow focus of the assimilation literature, we employ a simple but flexible and transparent decomposition method based on fixed effects regression models. It complements the custom all-in-one assimilation measure based on the years-since-migration with several components of wage assimilation, for example search gains, employment stability, and tenure effects, and renders a more detailed picture of how foreigners integrate themselves into the labor market. Our analysis, which is conducted for several countries of separate origin, indicates that the foreigners starting with higher entry wages experience greater wage growth in subsequent years. A good deal of the wage growth observed for the most successful nationalities can however be explained by sample composition effects—that is, non-random outmigration of the less successful foreign workers. We do not try to eliminate this effect but rather determine its importance. Then, our analysis breaks down the wage growth beyond the composition, aging, and trend effects into further components. We find that genuine wage assimilation happens mainly through three channels. First, it occurs through the accumulation of firm-specific human capital, which explains approximately 40 percent of the genuine assimilation for the aggregate of foreigners. Second, search gains are approximately the same order of magnitude. And third, the accumulation of general human capital explains one fifth of the assimilation. Other factors such as the change of citizenship or network effects are of minor importance. We further demonstrate that the importance of these channels differs by the origin groups: while some nationalities improve their wages primarily by accumulating firm-specific human capital, others yield the bulk of wage assimilation by moving to better-paying industries and occupations. Hence, we add to the existing literature in two ways. First, we explore the mechanisms behind wage assimilation in further detail. Second, the size of our estimation sample allows us to conduct the analysis separately for several nationalities and for specific entry years. This enables us to emphasize and to explain the heterogeneity in wage adjustment strategies between the workers of different nationalities. As a further advantage to other studies, our approach does not

require the assumption that the effects of cyclical fluctuations are identical for the wages of foreigners and natives (as criticized by Borjas, 1987 or Barth *et al.*, 2004).

It is worthwhile to emphasize that our approach refers to the explanations for genuine wage assimilations used in the literature.<sup>1</sup> First, after the devaluation of culturally specific human capital due to migration (see Chiswick, 1978; Friedberg, 2000; and Chiswick and Miller, 2009), immigrants invest in local human capital: they acquire language skills, accumulate other general human capital, and become acquainted with the host country's labor market. Second, they search for better-paying jobs or better matches. And third, employers obtain information of the foreigners' productivity over time. The latter should include the effect that foreigners increase their firm-specific human capital during the employment and hence should have the chance to climb the career ladder within the firm.

Finally, we want to mention that our analysis addresses the problems arising when investigating these channels: cohort effects and the effects of selective outmigration. Both might be totally different for the migrants from different origin countries: in the debate on the innate ability of migrants entering the U.S. since the 1960s,<sup>2</sup> Borjas (1987, p. 552) actually finds "strong country-specific fixed effects in the (labour market) quality of foreign-born persons." This finding highlights the importance of differentiating immigrants according to their home country. The same is true when turning to selective outmigration: Borjas and Bratsberg (1996, p. 175) detect "substantial variation across origin countries" with respect to outmigration rates. Dustman (1993, 2000) emphasizes that migrants envisaging the date of their return to their home country might invest less in host country-specific human capital. If it is predominantly the unsuccessful migrants who leave the host country, the share of successful migrants increases over time. This sample composition effect is interesting on its own as it measures whether integration problems are "solved" by exit options. Therefore, we do not eliminate this effect but rather identify its (country of origin-specific) magnitude when isolating the genuine assimilation effects based on the observable characteristics. Coming back to the changing cohort quality over time, we argue that this does not affect our results because our large observation numbers allow us to focus on narrowly specified cohorts entering the German labor market between 1999 and 2001.

Not least because of these problems, there is no clear picture in the empirical literature for Germany as to whether foreigners are able to catch up over the years.<sup>3</sup> While Constant and Massey (2005), Gundel and Peters (2007), and, to some extent, Fertig and Schurer (2007) (for two out of four cohorts) find evidence in favor of an assimilation process, the majority of studies (Pischke, 1992; Dustmann, 1993; Licht and Steiner, 1994; Schmidt, 1997; Bauer *et al.*, 2005) do not. It is worth

<sup>1</sup>See Chiswick (1978), LaLonde and Topel (1997), and Borjas (1999), or more recently, Eckstein and Weiss (2004) and Damas de Matos (2011).

<sup>2</sup>The debate started with Chiswick's (1978, p. 901) conclusion that "immigrants to the United States have more innate ability or motivation relevant to the labour market than native-born persons." Borjas (1987) objects that this conclusion is valid only if the income distribution in the host country is more dispersed than in the home country (see also, for instance, Borjas, 1995; LaLonde and Topel, 1997; Card, 2005; Lubotsky, 2007; or most recently, Borjas, 2013).

<sup>3</sup>All empirical studies for Germany find, however, significant native-foreigner differences in the wage levels. See, for instance, Diekmann *et al.* (1993), Velling (1995), Aldashev *et al.* (2008), Algan *et al.* (2010), or Lehmer and Ludsteck (2011).

noting here that all of these studies use the SOEP survey in which the number of foreigners is limited. This compels researchers to pool entry cohorts over several years, which generates additional problems related to changes in the cohort quality. A further—possibly severe—problem may be induced by the low survey response rates of foreigners. This biases assimilation analyses if both the response rates and wages depend on language skills. Our data demonstrate a clear advantage in this respect. On the one hand, the year of entry into Germany is measured with errors in our data, as we observe only when a person enters the labor market through dependent work (or registered unemployment) but *not* when that person enters Germany. On the other hand, we observe *all* dependent workers in Germany and can track their employment biographies with daily accuracy. This appears to be more important than knowing the precise year of entry for a small and *highly selective* sample of foreigners.<sup>4</sup> A clear disadvantage of all survey datasets for Germany is that the sample size restrictions prohibit detecting and analyzing differences between the countries of origin in a sufficiently differentiated manner.

The remainder of the paper is organized as follows. The next section addresses a description of our data source, presents some descriptive statistics, and gives evidence concerning the raw wage gap between a specific foreigner group and Germans. Section 3 describes the estimation approach. In Section 4, we present the results. Section 5 concludes.

## 2. DATA DESCRIPTION AND DESCRIPTIVE EVIDENCE

### 2.1. *Data*

Our analyses are based on data extracts from the Integrated Employment Biographies (IEB) of the Institute for Employment Research (IAB). The IEB covers event history data on all employees liable to social security, benefit recipients, people who are searching for employment, and unemployed people and participants in measures of active labor market policy. Thus, the dataset provides detailed information on a person's employment and benefit recipient history. We extract a full sample of all male foreigners<sup>5</sup> who were registered in the IEB at least once between January 1, 1995 and December 31, 2008 (this means we selected persons with at least one term as a foreigner within this time span, thereby making sure that the persons were not registered in the IEB before 1995). This restriction to male foreigners is required because the gender differences between nationalities (see Kalter and Granato, 2007; Lehmer and Ludsteck, 2011) can be expected to have a large impact on the nationality-specific assimilation processes. Altogether this basic data extraction contains approximately 3 million male foreigners for whom we have information on important personal characteristics (e.g., sex, age, qualification level, job/unemployment status, occupation, industry, establishment

<sup>4</sup>Kreuter *et al.* (2010) find clear evidence for a sizeable non-response bias regarding citizenship for the PASS data, which implies an underestimation of the true population proportion of roughly 40 percent.

<sup>5</sup>Note that German resettlers who emigrated from the former Soviet Union are Germans by law when immigrating and are therefore not included in the foreigner sample.

identifiers, wages, and unemployment durations). Of particular interest for our purpose is the nationality variable. Because the nationality variable in our data is afflicted with certain errors, a first step is to improve its quality. For instance, we observe that a person is Turkish from 2000 to 2003, and in 2004 the nationality variable has changed to German. The information is either correct—i.e., the person has received German citizenship—or an error has occurred (this is sometimes the case when people start working for a new employer). By analyzing the complete biographies, we check the reliability of such changes. We apply an imputation procedure and—coming back to the example—trust the change if the reliability-weighted subsequent spells are predominantly German. The reliability weights are 0.6 for unemployment spells and 0.3 for employment spells. Unemployment spells obtain greater weights because information from the job centers appears more reliable than from the employers. If they are Turkish for the most part (i.e., it turns out to be a back and forth change), then we correct the nationality variable. For approximately 4 percent of all cases, however, the imputation procedure indicates that a person begins with a German nationality and changes to a foreign nationality thereafter. These individuals are dropped from our foreigner sample. Additionally, we drop all individuals where the imputation procedure still leaves missings (approximately 0.5 percent of all individuals).

To increase the comparability between the migrant groups and to reduce cohort effects, we restrict our analysis in the first step to a specific entry cohort of foreigners defined as those who experienced their first full-time employment in the German labor market in the years 1999, 2000, or 2001. (Full-time employment is defined here as employment subject to social insurance contributions, excluding apprenticeship training, part-time employment, and marginal employment.) This allows us to analyze the assimilation process for up to eight years. Furthermore, we drop all individuals with spells as apprentices or student trainees. This is necessary because (i) wages during apprenticeships are strictly regulated (which makes it impossible to measure wage assimilation), (ii) persons with apprenticeship spells in Germany are likely to be second-generation movers (we focus on first-generation movers), and (iii) those who study at German universities and enter the labor market thereafter seem to be a highly selective group. Although our data source provides no information regarding where the persons in our sample are born, we are quite confident that these restrictions drop a significant part of second- or third-generation migrants from the sample. Thus, the foreigner sample consists for the most part of first-generation migrants.<sup>6</sup>

We draw a 2 percent random sample of male Germans (666,484 persons) from the IEB to obtain a comparison group of natives. Within this sample, we drop all individuals who are initially registered as foreigners in the data. Additionally, we apply the nationality variable imputation to control for missings and changes within the nationality variable. Individuals demonstrating reliable episodes as foreigners in their biography are dropped. Because the cohort of foreigners is

<sup>6</sup>Exceptions (i.e., the presence of second- or third-generation migrants in the sample) are most probably for the traditional guest worker countries such as Greece, Italy, Portugal, and also Turkey. An additional check, however, which compares the numbers of entrants identified from our database with the official immigration numbers published by the German statistical office, reveals a high level of agreement.

restricted to those who experience their first full-time employment in the German labor market in the years 1999 to 2001, we ensure that the Germans are also employed full-time at least once during this time span. As the German sample is still huge compared to that of the foreigners, 100,000 persons (with 2.7 million observations) are selected randomly in the final step.

Because specific groups of foreigners, particularly Poles, are often employed disproportionately as seasonal workers, and seasonal work compensation differs considerably from other employment relations, we furthermore exclude all individuals who have ever worked in the agricultural sector from the sample to increase the comparability between nationalities. For the same reason and to avoid problems due to imprecise working time information in our data, we restrict the sample to full-time workers aged between 20 and 60.<sup>7</sup> As a final restriction, we drop observations of foreigners from neighboring countries where the place of residence variable indicates foreign residence. This group should not be compared with the rest of the sample because cross-border commuters are likely to accept lower wage offers due to the lower living costs in the home country.

The final estimations sample contains more than 84,000 Germans and 222,000 foreigners with more than 2.5 million observations (see Table A1 in the Appendix). This large sample allows us not only to differentiate between country groups (for instance, classical EU countries, traditional guest worker countries, or Eastern European countries) but also to analyze specific nationalities. In addition to Germans, the largest ethnicities in our sample are Turks (38,289), Italians (15,404), and Yugoslavians (13,342). Table A1 presents the number of individuals representing the most important nationalities; all other foreigners are collected in the categories “Other Eastern European,” “Other Advanced,” and “Other.” Altogether, we differentiate between 30 foreign nationality groups in our analysis.

## 2.2. *Basic Background Information on Institutional Issues and Migration Motives*

Because the assimilation of migrants depends heavily on the motives for their decision to migrate and on their social and economic background, which may vary widely between the home countries, some background information concerning the immigration to Germany may help to understand the descriptive statistics and to put them into context. In the 1990s and 2000s, the immigration of foreigners to Germany was mainly characterized by the influx of EU-citizens, the reunification of spouses and family members, migrations of Jews from the territory of the former Soviet Union, the receiving of asylum seekers and refugees (especially from the former territory of Yugoslavia), seasonal, contractual, and guest workers from non-EU-countries, and the influx of IT-specialists and foreign university students. These types of migration differ with regard to immigration rules and the regulations relating to residence law. A foreigner who wants to enter Germany to work here—in principle—has to apply for a visa at the place of German foreign representation in the country of origin. The embassy or consulate then involves the

<sup>7</sup>We checked whether the restriction eliminates a great deal of the variation in working hours using the German Microcensus data in which working hours are reported exactly. After restricting the sample to full-time prime-aged male workers, we actually find only minor differences in working hours between nationality groups.

relevant authority in that country and the International Placement Services (ZAV) of the Federal Employment Agency to make a decision on the residence (including employment) permit. EU-citizens or persons from member states of the European Economic Area, however, are exempted from this regulation. By contrast, for third-country foreigners the relevant institutions investigate several approval provisions; for instance, whether foreign employment causes adverse impacts on the labor market, or whether there are any German natives who should be given preference (priority review). This example indicates that the entry conditions to the labor market are quite different across the various immigrant groups (which are basically included in our full sample as long as they are male) mentioned above. Therefore, we increase the comparability between nationalities by focusing on the years-1999–2001 cohort. The estimation sample is homogeneous in the sense that all the foreigners succeed in getting a full-time job, whatever the regulation for them might be. Moreover, the comparability is increased by implementing the further restrictions described above. For instance, seasonal workers who used to obtain work permission for only a few months per year are not included in the estimation sample because they cannot be compared with immigrants who want to stay in Germany for their entire life. Other groups who are excluded as a result of our restrictions are foreign students and second-generation movers. The next section examines whether our restrictions imply significant differences with regard to some important characteristics.

### *2.3. Descriptive Evidence on the Sample Means of the Estimation Sample and the Full Sample of Foreigners*

Table A2 displays the sample means for the estimation sample of Germans and foreigners<sup>8</sup> (columns 1 and 2) over the entire estimation period 1999 to 2008 and, for the sake of comparison, for the basic data extract of foreigners (column 3) observed from 1995 to 2008. It can be observed that the average wage is distinctly higher for Germans than for an aggregated group of foreigners. Wages are measured as gross daily earnings and are deflated to 1995 prices; the dependent variable in our analysis is the logarithm of this wage measure—that is, the log real wage. Because misreporting by employers is subject to severe penalties, the wage variable in the IEB data is highly reliable. The wages are, however, censored at the upper social contribution threshold for roughly 10 percent of all German male full-time workers (for the foreigners, the censoring share is below 2 percent). To account for this, all wages in the estimation sample are imputed using the standard Tobit models. The specification of the imputation model mimics that of the estimation model and is estimated for each nationality separately. To preserve the wage dispersion in the censored range, an error term (drawn from an appropriately truncated normal distribution) is added to the predicted censored wages. See Gartner (2005) for a detailed description of the procedure.

Note that a direct comparison of the final estimation sample with the basic data extract of foreigners is complicated by the fact that the latter includes a large number of part-time employment, unemployment, and marginal employment

<sup>8</sup>The sample means for each of the 30 foreign nationality groups are available from the authors upon request.

spells. The comparability of wages therefore has to be ensured by focusing on the full-time employment spells alone.<sup>9</sup> In so doing, the wages tend to be somewhat lower in the full sample. This might be explained by the age structure, in addition to other factors. The average age of foreigners is 31 years in the full sample and 33 years in the estimation sample. Because the full sample also contains men entering the German labor market after 2001, this is not surprising. In contrast, the differential to Germans (41 years) is more pronounced again. The same is true for the majority of the other variables presented in Table A2. Foreigners tend to be low-skilled and tend to work in smaller establishments. The most striking difference between the foreigners of the final estimations sample and the basic data extracts can be seen in the respective proportion of highly skilled persons holding a degree from a university or university of applied science as a share of all the employment spells over the observation period, approximately 12 percent for the former and only 6 percent for the latter. Another differential concerns the reliable changes to German citizenship (denoted as *chgerm* in the analysis below), in which we observe more changes in the full sample (14 percent vs. 12 percent). Again, one can assume that this is driven by the longer observation period of the full sample. Additionally, we include two dummy variables that use the information from the nationality variable imputation procedure. These variables capture the differences between the nationality information given by the employer and the information from the workers' complete employment biography: *chnat1* takes on the value unity if the employer registers the person as a German although he is actually a foreigner, and *chnat2* captures the opposite. Only minor differences are visible for both variables. Employment stability (measured as days in full-time employment per year and divided by 365) is comparable to the final estimation sample (73 percent) and to the full-sample (74 percent) and in the case of both distinctly lower than for German natives (93 percent). No difference can be found with regard to the share of fellow nationals working in the same region. As mentioned below, this variable will be included in the analysis to capture the possible effects of networks on the assimilation process. Altogether, the descriptive evidence on the presented variables indicates only small differences between the estimation sample of foreigners and the full sample of foreigners. Hence, this finding suggests that restricting the data to foreigners experiencing their first full-time employment in the German labor market in the years 1999 to 2001 does not produce a noteworthy selectivity bias.

#### 2.4. *Descriptive Evidence Concerning the Raw Wage Gaps and the Wage Adjustment of Specific Foreigner Groups Compared with Germans*

We continue by looking at the raw wage gaps between different foreigner groups and German natives when starting full-time employment in Germany. We begin by presenting the raw gaps for all migrants together as well as for five aggregated groups (see Table 1). As seen from Figure 3, this aggregation into broad categories masks important differences regarding the wage gaps and adjustment

<sup>9</sup>The same problem exists for other variables such as tenure, establishment size, and employment stability. If the information for the basic foreigner sample is drawn from full-time employment spells, it is indicated in Table A2 with an asterisk.



TABLE 1

WAGE GAPS OF SPECIFIC FOREIGNER GROUPS COMPARED TO GERMANS IN THE YEAR OF ENTRY (1999, 2000, OR 2001, RESPECTIVELY), EIGHT YEARS LATER, AND THE WAGE ADJUSTMENT BETWEEN

	Entry	Wage Gap	Wage	Entry	Wage Gap	Wage
	Wage	After	Gap	Wage	After	Gap
	Gap	8 Years	Adjustment	Gap	8 Years	Adjustment
	Unweighted			Age And Education Adjusted		
All Migrants	-56.6	-42.5	14.1	-31.0	-17.4	13.6
EU and Advanced	-3.9	32.1	36.1	17.4	39.7	22.3
Trad. Guest Worker	-69.4	-52.1	17.3	-52.0	-34.9	17.0
Turkey	-69.7	-56.4	13.3	-56.4	-42.9	13.5
Eastern European	-51.6	-30.6	21.0	-41.3	-22.8	18.6
Other	-66.7	-56.2	10.5	-46.0	-33.2	12.8

*Notes:* The category “EU and Advanced” contains migrants from Spain, France, U.K., Austria, the Netherlands, U.S., and other advanced industrialized countries, for instance, Sweden, Switzerland, Denmark, Japan, and Canada; “Traditional Guest Worker” countries are Italy, Portugal, Greece, Yugoslavia, and Croatia; “Eastern European” migrants are from Poland, Romania, Hungary, Slovakia, Ukraine, Russia, the Czech Republic, and Bulgaria.

effects between nationalities. To avoid being inundated with the details at the outset, the discussion of these differences is shifted to Section 4.3.

If we lump together all migrants and do not adjust for any differences in the characteristics between migrants and native Germans, the mean entry wage gap is -57 log points (see the left-hand panel of Table 1). After seven years, the wage gap is -43 log points; hence, the corresponding wage adjustment between the starting and end points of the observation period is 14 log percentage points. Observing different origin groups separately, it turns out that the entry wage gaps differ significantly. Migrants from the traditional guest-worker countries start full-time employment with an earnings disadvantage of -69 log points relative to Germans. The entry wage gap for Turks is -70 log points; for Eastern-Europeans, -52 log points. Migrants from the EU and other advanced industrial countries, however, have a very small wage gap: -4 log points. Table 1 clearly presents the fact that for each of the aggregated groups, the wage adjustment in succeeding years is positive and significantly different from zero. We observe the largest wage adjustments for the “EU and Advanced” group (36 log percentage points) and the lowest for the “Other” category (all countries not contained in one of the former categories; 11 log percentage points). The adjustments for Eastern Europeans (21 log percentage points), migrants from traditional guest worker countries (17 log percentage points), and Turks (13 log percentage points) lies in between. It is worth noting that the wage gaps in the last year of observation remain—despite significant wage adjustments—below -50 log points for three out of five country groups (Trad. Guest Worker, Turkey, and Other). Contrarily, migrants from the EU and advanced countries earn 32 log points more than the average German worker when they are observed seven years after their entry into full-time employment.

As mentioned above, the presented wage adjustment ignores the differences in characteristics between migrants and native Germans. The standard approach in the literature, however, measures the wage adjustment controlling for age and education (see Borjas, 2013). To compare our results with those from the

literature, we compute counterfactual adjustment effects that would result if the foreigners had the same skill and age distribution as the Germans by reweighting the specific foreigner group sample such that it exhibits the same skill and age distribution as the Germans. It can be observed from the right-hand panel of Table 1 that the entry wage gap for the aggregate of all migrants decreases (from  $-57$  to  $-31$  log points) if one takes into account that Germans are on average older and more educated than foreigners. The wage growth, however, is not affected by the age/education adjustment and remains at 14 log percentage points for the observation period—that is, the annual wage gain is approximately 2 log percentage points. This figure is in the same order of magnitude as has been estimated for other countries.<sup>10</sup>

Another more important reason for adjusting age and education is to investigate whether the differences in assimilation patterns between the aggregated foreigner groups (or nationalities) are merely reflecting differences in these characteristics: as the age profiles are non-linear and exhibit steeper increases for the young, a greater wage adjustment for some countries could be caused by the fact that they are younger on average. Better educated immigrants (on average the case for the EU and advanced countries) might demonstrate completely different assimilation patterns compared with immigrants from countries where the education level is low (for instance, Turkey).<sup>11</sup> Actually, the wage growth for migrants from the EU and advanced countries decreases substantially (from 36 to 22 log percentage points) when adjusting for age and education. Although the wage adjustment is not or is just slightly affected for other foreigner groups, the differences in age and education will be taken into account when analyzing the components of the wage adjustment (see Section 4.4).

As briefly discussed in Section 1, the differences in adjustment remain less meaningful from a theoretical point of view and are hardly usable for policy interventions until we can decompose them into adjustments due to the changes of observed characteristics and selection effects. The next section presents our straightforward decomposition approach.

### 3. METHODS

The descriptive evidence presented above reveals marked differences in the wage adjustments of different foreigner groups. To explain these differences, we estimate the fixed effects regression models separately for each foreigner group and German natives. We then multiply (separately for each foreigner group and for the German natives) the estimated coefficients by the difference (between the last and the first year) of the means of the regressors to obtain model-based predictions of wage changes. Assimilation rates are then computed as the difference between the predicted wage changes of natives and a specific foreigner group. The

<sup>10</sup>Lubotsky (2007) estimates a wage adjustment of 20 percentage points in 10 years for the cohort entering the U.S. between 1980 and 1994. Borjas (2013) finds for the U.S. a 10-year wage growth effect of 9–13 percentage points for cohorts arriving until 1990 (for more recent cohorts, however, the wage adjustment is close to zero). For Portugal, Damas de Matos (2011) identifies an annual wage growth of 1 percentage point in the first years.

<sup>11</sup>We thank an anonymous referee for urging us to take this issue seriously and to analyze it.

decomposition is obtained in a straightforward way by performing the steps above for individual regressors or groups of regressors separately and computing their contributions in the gross assimilation rate

The wage equation for a group of foreign workers and the reference group of German workers is specified as

$$\ln w_{it} = x'_{it}\beta + \sum_{t=1}^T d_t\gamma_t + \phi_i + \varepsilon_{it} \quad \text{and} \quad \ln W_{it} = X'_{it}B + \sum_{t=1}^T D_t\Gamma_t + \Phi_i + E_{it},$$

respectively. Here,  $\ln w_{it}$  and  $\ln W_{it}$  stand for the logarithm of gross daily earnings (deflated to 1995 prices) for person  $i$  at time  $t$ , the  $x_{it}$  ( $X_{it}$ ) are vectors of individual and establishment-level control variables, the  $d_t$  ( $D_t$ ) are year dummies and  $\beta$  ( $B$ ),  $\delta$  ( $\Delta$ ), and  $\gamma$  ( $\Gamma$ ) contain the corresponding coefficients. The error term comprises the fixed individual effects  $\phi_i$  ( $\Phi_i$ ) and residuals  $\varepsilon_{it}$  ( $E_{it}$ ), which are assumed to be uncorrelated with all of the other right-hand side variables. The age and trend effects are captured by the year dummies  $d_t$  and  $D_t$ .

Before discussing the properties and the specification of the regression models, we give a more formal description of the decomposition method. As sketched above, the contributions of the various right-hand side variables to wage convergence between a foreigner group compared with native Germans are assessed by generating predictions based on the estimated model. The mean predictions for the first and last year of the estimation period for the foreigner group and the Germans can then be used to form a differences-in-differences estimate of wage convergence. For example, the change of the log wage differences between a migrant group and German natives for the period 2000 to 2007 explained by the  $k$ -th regressor  $x_{kit}$  ( $X_{kit}$ ) is given by  $(\bar{x}_{k\bullet e} - \bar{x}_{k\bullet s})\hat{\beta}_k - (\bar{X}_{k\bullet e} - \bar{X}_{k\bullet s})\hat{B}_k$ , where  $\bar{x}_{k\bullet s}$  and  $\bar{x}_{k\bullet e}$  denote the mean of  $x_{k\bullet t}$  for the start and end year of the considered estimation period, and all other means are defined correspondingly. Similarly, the changes in the migrant–German wage gap caused by the selectivity based on unobserved time-constant characteristics are given by  $(\bar{\phi}_e - \bar{\phi}_s) - (\bar{\Phi}_e - \bar{\Phi}_s)$ . A summary decomposition as presented in Figure 1 is obtained by dividing the regressors into three categories: wage assimilation defined as the adjustment due to observed time-varying characteristics such as tenure or change of industry/occupation (hereinafter referred to as *Observed Excluding Age and Trend*), further adjustment due to the unobserved time-varying factors and age as discussed above (hereinafter *Age and Trend*), and a third component capturing the adjustment due to changes in the sample composition (hereinafter *Composition Effects*). Formally this is

$$\begin{aligned} (\ln \bar{w}_{\bullet e} - \ln \bar{w}_{\bullet s}) - (\ln \bar{W}_{\bullet e} - \ln \bar{W}_{\bullet s}) &= \underbrace{(\bar{x}_{\bullet e} - \bar{x}_{\bullet s})\hat{\beta} - (\bar{X}_{\bullet e} - \bar{X}_{\bullet s})\hat{B}}_{\text{Observed}} + \\ &\quad \underbrace{(\bar{d}_e\hat{\gamma}_e - \bar{d}_s\hat{\gamma}_s) - (\bar{D}_e\hat{\Gamma}_e - \bar{D}_s\hat{\Gamma}_s)}_{\text{Age and Trend}} + \\ &\quad \underbrace{(\bar{\phi}_e - \bar{\phi}_s) - (\bar{\Phi}_e - \bar{\Phi}_s)}_{\text{Composition}} \end{aligned}$$

where the time indexes  $s$  and  $e$  refer to the start and end year of the estimation period. For example,  $s = 2000$  and  $e = 2007$  for the cohort with the first full time spell in 2000. Although the size of our dataset would allow us to focus on a specific cohort, it is unclear a priori whether it is representative for preceding and succeeding cohorts. To check this, we performed the decomposition for the three cohorts 1999/2006, 2000/2007, and 2001/2008 (the first number refers to the year with the first full-time spell and the second to the last year when this cohort is observed) and compared the results. This revealed only small deviations between the cohorts for most countries. Because these deviations were greater than suggested by the very small standard errors, however, we decided to report averages over the three cohorts.<sup>12</sup>

To improve the understanding of our approach and to put it into context with the standard approach, it is instructive to compare it with the one applied by Damas de Matos (2011). She conducts fixed effects regressions on a pooled sample of migrants and natives and measures assimilation via an interaction term between the migrant dummy and the years since migration. The contributions of other characteristics to the assimilation process are obtained indirectly by adding controls for these variables one by one and inferring their effects from the induced decrease of the years-since-migration coefficient. We add all characteristics once and obtain their contributions directly by multiplying the coefficients with the changes of the average characteristics. Although the alternative approach based on the omitted-variables formula is simple, it does not yield a consistent decomposition because the inferred contributions of the characteristics are not invariant to the order in which the characteristics are added to the model.<sup>13</sup>

Let us now turn to a discussion of the specification of the regression model. As already mentioned, assimilation is usually measured using a linear or quadratic term for the age or the years since migration. We prefer a set of year dummies instead because they also capture idiosyncratic year shocks. Particularly if the age/trend term is not mainly taken as a control but interpreted directly, a smooth polynomial in age would, however, be more robust against exceptional shocks to the first or last year. To check this, we ran alternative regressions including the linear and quadratic age (instead of the year dummies) and found only minor deviations from the results reported here. Next, we consider the separation of the age (or experience in the host country) from the trend effects. Although the fixed effects regressions are attractive for several reasons, they clearly restrict the interpretation of the age/trend effects because they cannot be separated from one another. This is problematic especially if foreigners' and Germans' wages respond differently to the business cycle. Therefore, our age/trend term can only be taken as a conglomerate of age, the foreigners' duration of stay in Germany, and other unobserved trend and time effects. The problem caused by the contamination from unobserved trend effects is mitigated somewhat by the fact that we conduct a

<sup>12</sup>The reported averages are obtained as arithmetic means (weighted by cohort size) over the decomposition results for the individual cohorts. Results for the individual cohorts are available from the authors upon request.

<sup>13</sup>Based on the Abowd *et al.* (1999) method, Damas de Matos provides a more comprehensive analysis of the sorting into firms. Our firm size term is only an imperfect proxy for the fixed firm effects.

difference-in-difference analysis—that is, we consider time changes of migrant wages *compared with those of the Germans*. This difference eliminates common shocks and is biased consequently only by the differing effects on foreigners and Germans. Despite these minor disclaimers, it is important to note that the separate estimation of the age/trend components purges *all other regressors* from distortions caused by the asymmetric time shocks.

Our specification includes several other variables that presumably have an impact on individual wages: the linear and squared terms of tenure, the log establishment size, the nine industry categories, the dummies controlling for the region (seven categories) and the region type (four categories), and the 12 aggregated occupation categories, as suggested by Blossfeld (1985). A further important determinant of wages should be employment stability. Nielsen *et al.* (2004), for instance, demonstrate for Denmark that the foreigner–native wage gap would be significantly decreased if foreigners had worked during their entire stay in the host country. In our approach, we measure employment stability as days employed per year. The remaining selectivity issues that are not captured by this variable will be discussed in more detail in Section 4.5.

Clearly, there are certain blind spots in our specifications. We cannot control for other time-varying personal characteristics, such as the marital status and the number of children and language skills, because they are not available in our data. Whereas the marital status and the number of children should be of minor importance for our estimation sample of full-time working men, recent empirical studies (e.g., Dustmann and van Soest, 2001, 2002; Aldashev *et al.*, 2009; Zibrowius, 2009) emphasize and substantiate the importance of language skills for foreigners' wages. Although the level effects of the language skills are captured by the fixed individual effects in our regressions, we clearly cannot control directly for their *changes*. Further inspection of the issue suggests, however, that controlling for them would not be possible in a satisfactory way even if the information on language skills had been available in our data because the measurement of language skills (which are typically obtained by the self-assessment of the foreigners) is imprecise and error-prone.<sup>14</sup> The omission of this important characteristic has to be kept in mind when interpreting the effects of the other variables below. Language fluency improves over time, and therefore it can be expected that it is captured mainly by the age/trend component. It may, however, be a prerequisite to find employment in the better-paid occupations or industries. Consequently, these covariates may reflect part of the language effects.

Some differences in the assimilation processes may be caused by the network effects that are addressed by the inclusion of a variable measuring the share of compatriots working in the same region. Additionally, we include three dummy variables that capture the information from the nationality variable imputation procedure. The first variable, *chgerm*, indicates a reliable change to German citizenship; the others capture differences between the nationality information given by the employer and the information from the workers' complete employment

<sup>14</sup>Dustmann and van Soest (2001) note that the misclassification of language skill info occurs frequently in the SOEP data because migrants may find it difficult to assess their speaking fluency in the first years after arrival. This lack of "assessment expertise" may induce revisions that inflate the variance of the variable.

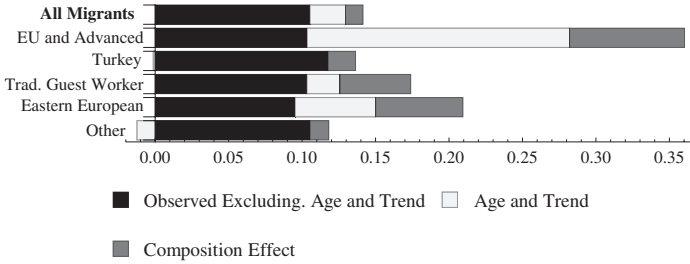


Figure 1. Raw Decomposition of the Wage Adjustment of Foreigners

Notes: The black bars “Observed Excluding Age and Trend” represent changes in the migrant/German (log) wage gap explained by all observed time-varying characteristics except the combined Age/Trend component as described in the model section. The gray bars (“Composition Effect”) represent changes in the migrant/German (log) wage gap explained by selectivity (measured as changes in yearly means of fixed person effects). The white bars (“Age and Trend”) represent a summary measure of the age and trend effects.

biography; *chnat1* takes on the value unity if the employer registers the person as German although he is actually a foreigner; and *chnat2* captures the opposite. As a last remark regarding the choice of explanatory variables, note that we cannot control for education directly as the education dummies cannot be included in our regression models due to time-invariance. In some sense, this is not a problem because time-invariant characteristics cannot contribute to assimilation *by definition* as they remain constant. Assimilation processes may, however, differ considerably across the skill groups. To check whether the effects of the *other* regressors differ considerably between the education groups, we run extended specifications where these regressors were interacted with a skill dummy. This exercise is problematic at the country level as the numbers of the highly skilled were too small for several countries to obtain precise estimates. Because it revealed only minor to moderate deviations from the base specification, we assess the role of heterogeneity between the education groups (and the age groups) using a simpler but robust reweighting approach in Section 4.4.

#### 4. RESULTS

##### 4.1. Decomposition of the Wage Adjustment of Foreigners

The results of the threefold decomposition are depicted in Figure 1 to visualize the relationship between the total wage adjustment and its components. Confidence intervals are omitted because all sizeable effects are statistically significant.<sup>15</sup> We neglect the age and educations differences between foreigner groups for a moment (this will be discussed in Section 4.4) and focus on the raw wage adjustment. To start with, consider the pooled group of all foreigners. Its wage adjustment of 14 log percentage points is explained mainly by the component *Observed Characteristics Excluding Age and Trend* (11 log percentage points)—that is, the time-varying

<sup>15</sup>Appendix Tables A3 and A4 contain the standard errors for all the decomposition effects at the sending country level.

observable characteristics. This part of the wage adjustment (about three-quarters) can be considered as genuine assimilation. The remaining part is due to the age and trend effects (2 log percentage points) and is only to a negligible degree due to the composition effects (1 log percentage point). This summary information is, however, of limited worth as it is to a large extent driven by the results of the Turks, who dominate the entire sample due to their huge weight. Differentiating by the foreigner groups demonstrates that the wage adjustment can mainly be explained by the observed characteristics for the two country groups with the most moderate wage growth (i.e., Turkey and Other). Both *Composition Effects* and *Age and Trend* effects play a minor role for these two. The situation is, however, quite different for migrants from the EU and advanced countries. The sample composition and the age and trend effects are much more important here: taken together they explain 70 percent of the raw wage adjustment. For the Eastern Europeans and foreigners from the traditional guest worker countries, the composition effects explain about one-third of the respective wage adjustment. Hence, a non-negligible part of the raw observed wage growth for these country groups is caused by the exit of the less successful individuals and is artificial in the sense that the highly productive workers remaining in Germany obtained better wages soon after entering Germany.

It is worth noting, however, that the genuine assimilation as it is captured by the component *Observed Characteristics Excluding Age and Trend* (the black bars in Figure 1) is in a small range of 10 (for Eastern Europeans) to 12 log percentage points (for Turks) for all country groups (but note that there is a strong nationality-specific heterogeneity; see Section 4.3).

#### 4.2. The Role of Firms, Human Capital Accumulation, and Search Gains

After having precisely identified the fraction of the wage adjustment due to sample composition effects and time-varying unobservables (instead of eliminating them), we use our decomposition model to dig even deeper: Figure 2 now only

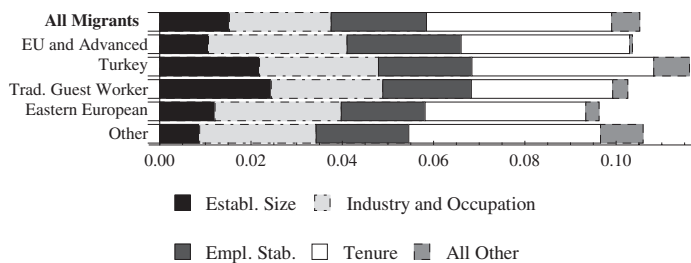


Figure 2. Decomposition of the Component “Observed Characteristics excluding Age and Trend”

*Notes:* Figure 2 visualizes the further decomposition of the black bars in Figure 1. The black bars (Establ. Size) in Figure 2 represent changes in the migrant/German (log) wage gap explained by changes in the (log) establishment size. The light gray bars (Tenure) represent the corresponding changes due to the tenure effects. The dark gray bars (Empl. Stab.) depict the effects of employment stability (measured as a share of days employed per year). Industry and Occupation capture the corresponding changes due to moves between industries and occupations. The other gray bars represent the changes due to all remaining observed covariates (excluding the trend and age component).

depicts the component *Observed Characteristics Excluding Age and Trend*—that is, we focus on genuine assimilation and its components.

From both the theoretical and policy points of view, it makes a difference whether assimilation takes place mainly through the improvement of general human capital, firm-specific human capital, or search gains. Although the informativeness of our observed covariates is limited, they give at least a rough indication in this respect. Figure 2 differentiates between the impact of *Establishment Size*, *Tenure*, *Employment Stability*, *Industry/Occupation*, and the totalled remaining effects (*All Other*).<sup>16</sup> We argue that *Industry and Occupation* and—at least to an extent—*Establishment Size* serve as the proxies for the realization of search gains: migrants might improve their wage position by moving to better paying (often larger) firms. For the same reason, they also might change industries or occupations. *Tenure* should capture wage assimilation due to the accumulation of firm-specific human capital (this includes upward moves in the firm hierarchy), whereas *Employment Stability* should capture mainly the wage effects of general human capital improvements.

For the aggregate of all foreigners, the adjustment through *Tenure* (4.1 log percentage points, white bar) explains a substantial part (40 percent) of the overall convergence. Hence, foreigners first increase their wages by accumulating firm-specific human capital and by improving their wage position within the firm. Further assimilation is accomplished by the change in *Industry and Occupation* (2.2 log percentage points), *Employment Stability* (2.1 log percentage points), and *Establishment Size* (1.5 log percentage points). Among the remaining effects that are subsumed under the label *All Other*<sup>17</sup> (0.6 log percentage point), the largest impact is caused by the changes to German citizenship.

Differentiating again for country groups gives a more nuanced picture. Although the improvement of firm-specific human capital measured by *Tenure* is very important for all country groups—explaining between 30 (Trad. Guest Worker) to 40 percent (Other) of the genuine wage assimilation—the assimilation channels still differ to some extent: moving to better paying (often larger) firms as it is captured by *Establishment Size* explains one-quarter of the genuine wage assimilation of the migrants from the traditional guest worker countries but only 10 percent for the EU and advanced country migrants. This is significantly smaller than the findings in a recent study for Portugal (Damas de Matos, 2011) where the wage catch-up due to firm changes is estimated to be approximately 30 percent. The sorting into better industries and occupations over time, captured by *Industry and Occupation*, explains a larger part (29 percent) of the wage assimilation for Eastern Europeans and foreigners from the EU and advanced countries than for the other foreigner groups. This can also be compared with Damas de Matos (2011) who find no effect for the Eastern Europeans and the other foreigner groups immigrating to Portugal. *Employment stability*, measured as days employed per

<sup>16</sup>Table A4 in the Appendix contains point estimates and standard errors for the predicted effects of *Establishment Size*, *Tenure*, *Employment Stability*, *Industry and Occupation*, and *All Other Characteristics*.

<sup>17</sup>*All Other* contains the effects of changing region, types of region, citizenship and network effects. Because they are of minor importance, they are not presented in the paper but are available from the authors upon request.



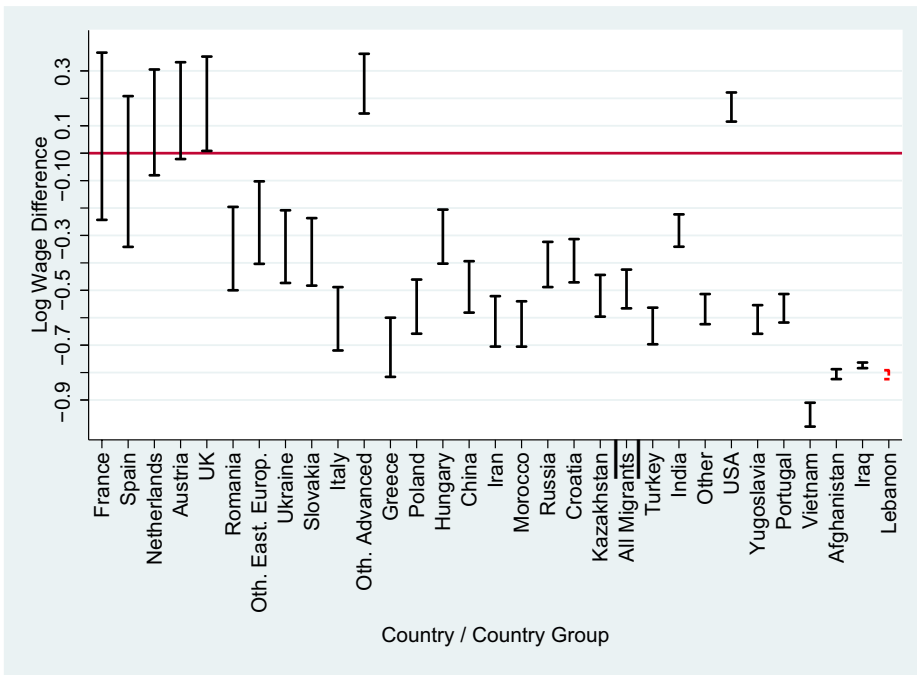


Figure 3. Wage Gaps of Specific Foreigner Groups Compared to Germans in the Year 2000 and 2008 and the Wage Adjustment Between

Notes: The countries are sorted according to the size of the total wage adjustment. The lower spikes of the solid bars represent the log wage differences (Germans minus foreigners) in the first year. The upper spikes represent the corresponding differences in the last year. The first year and last year values are interchanged for the dashed bar, referring to Lebanon (here the lower spike corresponds to the last year and the upper to the first year).

Reading example: The log wage difference between All Migrants and native Germans was roughly  $-0.57$  log points in the first year and decreased to roughly  $-0.43$  log points in the last year.

year, adds especially to the wage convergence of foreigners from the EU and advanced countries (24 percent) and is again less pronounced for the Turks, Eastern Europeans, and foreigners from the traditional guest worker countries (each approximately 18 percent).

Altogether, these results indicate that genuine wage assimilation happens through three channels: first, the accumulation of firm-specific human capital, which explains approximately 40 percent of genuine assimilation; second, summing up the effects of changing firms, industries, and occupations, the realization of search gains explains approximately the same fraction; and third, the accumulation of general human capital explains one-fifth. Other factors such as the change of citizenship or network effects are of minor importance.

#### 4.3. Heterogeneity between the Origin Groups

Arranging the foreigners into five coarse groups is suitable to gain a crisp overview of the issue and to assess whether, for example, the assimilation of

foreigners from advanced industrial countries differs from that of the traditional guest worker sending countries. However, this grouping swallows a good deal of the heterogeneity between the origin groups. This can be understood by looking at Figure 3, which depicts the raw decomposition of Table 1 at the origin country level. The spectrum of the gross assimilation rates is considerably greater now, ranging from negative or very small rates for foreigners from Lebanon, Iraq, and Afghanistan to extremely large rates exceeding 60 log points for France. Moreover, it can be observed from Figure 3 that foreigners starting with higher entry wages tend to experience greater wage growth in subsequent years.

From Figure 4 it is evident that the heterogeneity is also much greater for the age and trend effects, which take on sizeable negative values for Vietnam and Lebanon but exceed 20 log points for France, Spain, and foreigners from the other advanced countries. We also observe that the composition effects explain almost a third of the gross assimilation rate for France and Spain, whereas they are absent for several countries such as Russia, Kazakhstan, and Turkey. The most important thing to be learned from Figure 4 seems to be, however, that the assimilation due to observed characteristics (the black bars) is positive for all nationalities and differs less across nationalities than the composition and age and trend effects.

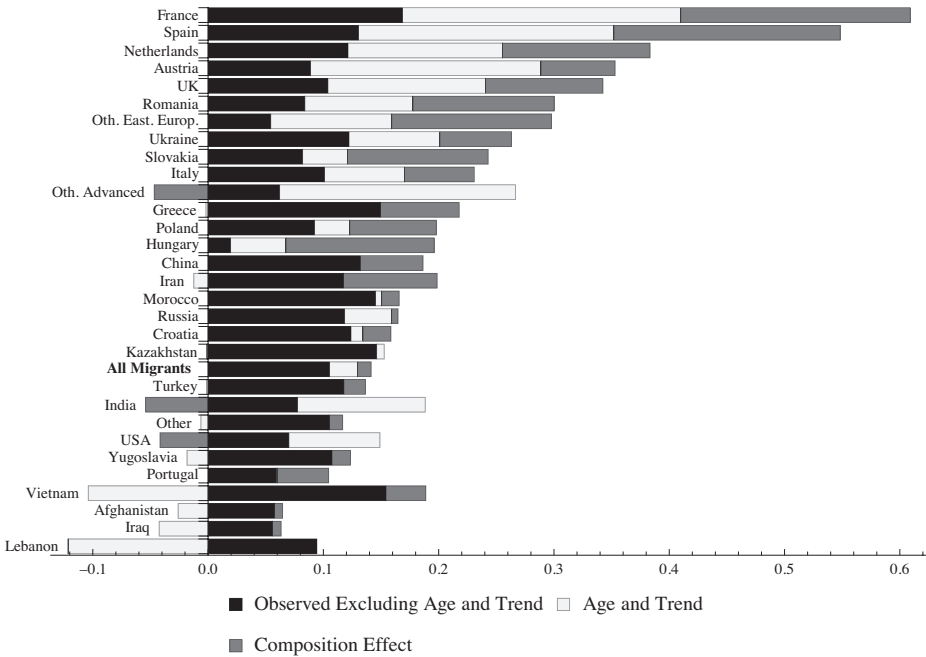


Figure 4. Decomposition of Wage Adjustment of Foreigners

*Notes:* The countries are sorted according to the size of the total wage adjustment. The black bars “Observed Excluding Age and Trend” represent changes in the migrant/German (log) wage gap explained by all observed time-varying characteristics except the combined Age and Trend component as described in the model section. The gray bars (“Composition Effect”) represent changes in the migrant/German (log) wage gap explained by selectivity (measured as the changes in the yearly means of fixed person effects). The white bars (“Age and Trend”) represent a summary measure of age and trend effects. See Table A3 in the Appendix for the standard errors of the predictions.

Figure 5 visualizes the further decomposition of the assimilation due to observed characteristics. It corroborates our view that the aggregation into broad categories masks substantial differences. Remember, for instance, the aggregated group of East Europeans for which the sorting into better industries and occupations explained a substantial part of the wage assimilation (29 percent). Considering now the single nationalities from Eastern Europe, it turns out that sorting into better industries and occupations is actually very important for the Poles, Russians, Ukrainians, and Romanians (explaining more than one-third) but, by contrast, plays only a minor role for Slovaks. As a further example, look at the traditional guest worker countries: the improvement of firm-specific human capital explains approximately 20 percent of the wage assimilation for migrants from Greece but 40 percent for the Croatians. Hence, the finding that *Tenure* effects are less important for the traditional guest worker migrants is not valid for each single nationality. It is worth mentioning, however, that the nationality-specific effects within the aggregated groups of the Eastern European and the traditional guest worker countries are less dispersed than between them.

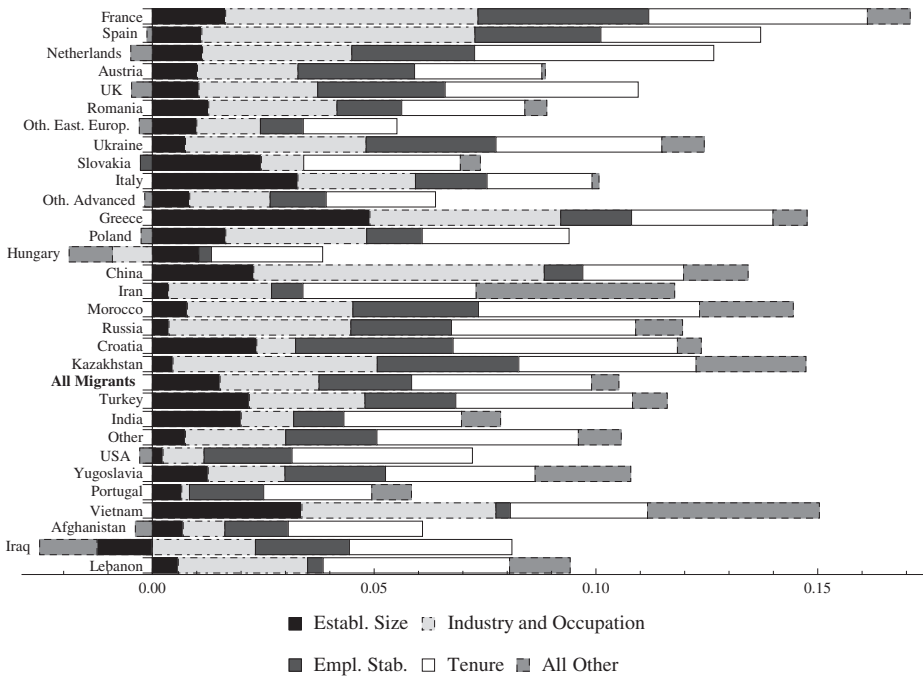


Figure 5. Decomposition of the Component “Observed Characteristics excluding Age and Trend”

Notes: The countries are sorted according to the size of the total wage adjustment. Figure 5 visualizes the further decomposition of the black bars in Figure 4. The black bars (Establ. Size) represent the changes in the migrant/German (log) wage gap explained by the changes in the (log) establishment size. The light gray bars (Tenure) represent corresponding changes due to the tenure effects. The dark gray bars (Empl. Stab.) depict the effects of employment stability (measured as a share of days employed per year). Industry and Occupation capture the corresponding changes due to moves between industries or occupations. The other gray bars represent the changes due to all remaining observed covariates (excluding the trend and age component). See Table A4 in the Appendix for the standard errors of the predictions.

To corroborate this finding, we investigate further whether our grouping that follows standard conventions by partitioning the nationalities heuristically along economic, political, and geographic dimensions is optimal in the sense that it minimizes the heterogeneity within groups. This question can be answered by feeding the decomposition results into a means-based cluster analysis procedure. As seen from Table A5, the purely data-driven partitioning would generate by and large similar results. For example, our groups “EU and Advanced” and “Eastern Europe” have an almost 1:1 correspondence with the clusters 2 and 3. The “Traditional Guest Worker” countries and the residual group “Other,” however, would be combined into one group by the data-driven clustering. Despite some deviations from the optimal partitioning scheme, the decomposition is based on the heuristic grouping as it fits better the conceptions of most readers.

#### 4.4. *Controlling for Differences in the Distribution of Education and Age*

The most conspicuous differences between the characteristics of foreigners and Germans in Table A2 are the distributions of education and age. The foreigners are with roughly 33 years considerably younger than the Germans (with approximately 41 years) and are a considerably greater share of the low-skilled workers (59 percent versus 11 percent among Germans). This provokes the question as to why the educational qualification does not show up in our analysis at all. A simple but less satisfying answer is that schooling and even vocational training degrees cannot contribute directly to assimilation because they do not change after entry into the labor market. To detect differences in the assimilation process across the skill groups, the decomposition can either be run separately for the skill groups, or the other time-varying variables can be interacted with the skill dummies. Because the former approach produces imprecise results at the country level due to the small observation numbers for the highly skilled, we followed the latter approach (by interacting trend terms, tenure, establishment size, and the number of days worked per year with a dummy for low qualification) and found that it induces only small changes in the decomposition results.

A similar problem arises with the age distribution. Although we include an age/trend term in our models, the greater age effects of the foreigners (compared to those of the Germans) may result simply because the age-earnings profiles are steeper for young workers and the foreigners are younger (than the Germans) on average. Although we think—in accordance with Borjas (1999, p. 1722)—that the “economic impact of immigration depends on how immigrants compare to natives, and not on how immigrants compare to statistically similar natives,” it is nevertheless interesting to assess how the assimilation process would look if the foreigners exhibited the same age distribution as the Germans.

Note that the Oaxaca–Blinder approach—that is, replacing the mean age and education of the foreigners with that of the Germans—does not produce the desired counterfactual assimilation effects because the differencing of mean characteristics drops the level information. The counterfactual changes can, however, be constructed by an extremely simple and transparent approach. Simply reweight the foreigners’ samples such that they mimic the distribution of the relevant characteristics of the Germans. We apply this approach to the distributions of age

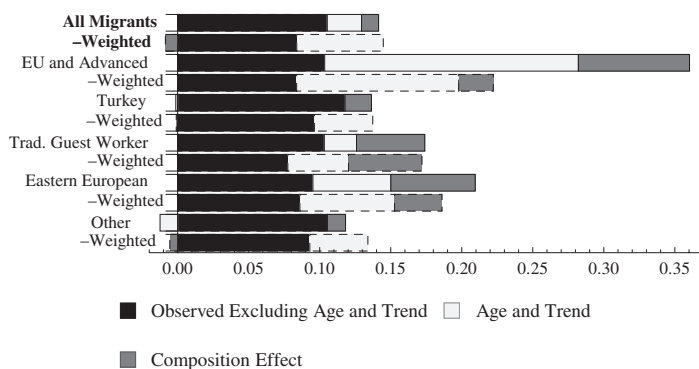


Figure 6. Decomposition of Wage Adjustment of Foreigners; Comparison of the Standard Results with those from an Age-education Adjusted Sample

*Notes:* The age-education adjusted results give the counterfactual change of the wage adjustment that would result if all the foreigner groups exhibited the same distribution of age and education as the Germans. They are depicted below the respective standard results for each country group. See the notes to Figure 1 for the interpretation of the bars.

and education simultaneously.<sup>18</sup> The results of this exercise are presented in Figure 6. To ease the comparison, they are rendered below the respective unweighted results. It becomes clear that the reweighting makes a noteworthy difference only for the group “EU and Advanced,” for which the age/trend effect shrinks from approximately 18 to approximately 12 log points. Further inspection reveals that this change is caused by the huge share of highly skilled workers among this group (amounting to approximately 33 percent and exceeding the German’s share by 21 percentage points). For all other groups, the differences between the weighted and unweighted results are rather small and unsystematic. The reweighted results for the detailed decomposition display even smaller and unsystematic deviations from the unweighted ones and are therefore shifted to an online Appendix.

#### 4.5. Sensitivity Analysis: Was There Significant Assimilation Before Starting Full-Time Employment?

The lack of exact working hours information in our data restricts the analysis to full-time employment. This may generate selectivity bias because migrants often attempt to gain a foothold in the host country’s labor market via part-time and minor jobs, possibly achieving considerable wage growth there. Furthermore, Nielsen *et al.* (2004) demonstrate that obtaining stable employment is an important prerequisite to assimilation for the foreigners in Denmark. Considering these facts, our sample selection strategy may obscure a good deal of assimilation by excluding part-time jobs and by “allowing” the foreigners to spend up to four years

<sup>18</sup>The approach is implemented by partitioning the sample into five age groups and two skill groups (unskilled and skilled plus highly-skilled). Then we compute the shares of these ten cells in the respective observation numbers for each country and obtain the reweighting factors as the ratios of the shares among Germans to the respective shares among foreigners.

in part-time employment before their first full-time spell and therefore to draw a highly selective or biased picture. To verify this, we constructed an alternative sample whereby the migrants may spend at most one year in part-time jobs before their first full-time employment spell (all the other selection criteria remain the same). It is unclear a priori whether the workers of the alternative sample exhibit smaller or greater entry wage gaps and assimilation rates than those from the standard sample. On the one hand, the shorter “warm-up” period provides less opportunity to learn and to increase their wages. On the other hand, its workers may demonstrate above-average motivation and productivity because they managed to acquire full-time employment soon after entering Germany. A glance at the data reveals that the duration of the warm-up-period has negligible effects on our results. The average foreigner–native wage gap (for all migrants) amounts to  $-57$  log points for our standard sample and  $-55$  log points for the alternative sample in the year of the first full-time spell. The most sizeable negative and positive wage differences between the samples are observed for Iran and India, for which they amount to  $-2$  and  $4$  log points, respectively. These differences are, however, quite small compared to the corresponding large first year wage gaps of  $-70$  and  $-34$  log points. The findings are similar for the assimilation rates and the decompositions for which we find only small and negligible deviations. The interested reader is referred to Table A6 in the Appendix for a listing of the migrant groups with the most extreme (but still small) deviations between the samples. Consequently, though the restriction of our sample demands that we remain quiet regarding the important and even growing area of minor and part-time work, this sensitivity check suggests that part-time work has no significant influence on the assimilation process of the full-timers and therefore can be ignored.

## 5. SUMMARY OF FINDINGS

This paper examined the sources of wage growth for the male foreigners in Germany by estimating fixed effects regressions for migrants and Germans separately. Based on the estimated coefficients, we assess the contributions of the various right-hand side variables to the wage convergence between migrants compared to native Germans by generating predictions from fixed effects regression models, which are averaged by year and used to compute the differences-in-differences measures of wage assimilation. This approach allows us to decompose the wage adjustment of foreigners into three components: (1) wage assimilation due to observed time-varying characteristics such as tenure or moves to better-paying industries and occupations; (2) the adjustment due to sample composition effects; and (3) a component capturing the adjustment due to unobserved time-varying factors, age and the years since migration. The further analysis of the other observed characteristics in (1) complements and extends the traditional approach that tries to condense assimilation in the age/years since migration component and treats all other effects as a nuisance.

If all foreigners are tarred with the same brush (by pooling them into one group), we find that the raw wage gap (compared to native Germans) decreases by 14 log percentage points in the first seven years after entering full-time employment. According to the decomposition results, this wage adjustment of 14

log percentage points can for the most part be traced back to time-varying observable characteristics—that is, genuine wage assimilation. We find that genuine wage assimilation happens mainly through three channels. First, assimilation is achieved through the accumulation of firm-specific human capital, which explains approximately 40 percent of the genuine assimilation for the aggregate of foreigners. Second, search gains are approximately the same order of magnitude. And third, the accumulation of general human capital explains one-fifth. Other factors such as the change of citizenship or network effects are of minor importance.

We further demonstrate—as a second contribution to the literature—that the importance of these channels differs by origin groups. Although improvement of firm-specific human capital is very important for all country groups—explaining up to 40 percent of genuine wage assimilation—there is noteworthy heterogeneity: moving to better paying firms explains one-quarter of genuine wage assimilation for the migrants from the traditional guest worker countries but only 10 percent for the EU and advanced country migrants. The sorting into better industries and occupations explains a larger part of wage assimilation for the Eastern Europeans and foreigners from the EU and advanced countries than for other foreigner groups. The improvement of general human capital adds especially to the wage convergence of the foreigners from the EU and advanced countries and is again less pronounced for the Turks, Eastern Europeans, and foreigners from the traditional guest worker countries.

Moreover, the size of our estimation sample allows us to differentiate between 30 nationality groups. For instance, we are able to look into the origin group East Europeans and can detect the effects separately for the Hungarians, Poles, Romanians, Russians, Slovaks, etc. Although we find substantial heterogeneity between the nationalities, the majority of the differences are obscured by the grouping of the nationalities. In summary, the nationality-specific results reveal considerable heterogeneity regarding adjustment and its causes, indicating that effective migrant policy should account for this heterogeneity by creating integration measures specifically for the different origin groups.

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### SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article at the publisher's web-site:

**Table A1:** Numbers of Observations and Persons by Country and Country Group

**Table A2:** Sample Means

**Table A3:** Point Estimates and Standard Errors for the Predictions Based on Estimated Coefficients; Base Decomposition

**Table A4:** Point Estimates and Standard Errors for the Predictions Based on Estimated Coefficients; Detailed Decomposition

**Table A5:** Comparison of the Grouping Schemes: Data-Driven Cluster Analysis versus the Heuristic Scheme

**Table A6:** Comparison of Wage Adjustment Rates between the Standard Sample and an Alternative Sample where Foreigners Spend at most one Year in Part-time and Minor Jobs Before their First Full-time Spell