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The Labor Market Performance of Immigrants in Germany

by Robert C. M. Beyer

I N T E R N A T I O N A L M O N E T A R Y F U N D

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European Department

The Labor Market Performance of Immigrants in Germany

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Authorized for distribution by Enrica Detragiache

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Abstract

The paper uses a large survey (GSOEP) to analyze the labor market performance of immigrants in Germany. It finds that new immigrant workers earn on average 20 percent less than native workers with otherwise identical characteristics. The gap is smaller for immigrants from advanced countries, with good German language skills, and with a German degree, and larger for others. The gap declines gradually over time. Less success in obtaining jobs with higher occupational autonomy explains half of the wage gap. Immigrants are also initially less likely to participate in the labor market and more likely to be unemployed. While participation fully converges after 20 years, immigrants always remain more likely to be unemployed than the native labor force.

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I. INTRODUCTION

After earlier waves in the 1960s and 1990s, immigration to Germany has been on the rise again since the Global Financial Crisis and skyrocketed in 2015, as over one million asylum seekers arrived, nearly twice as many as during previous heights in the 1990s. Germany is currently the second most popular migration destination in the world.

Besides addressing pressing humanitarian concerns, immigration could potentially counterbalance the expected gradual decline of the working age population as a result of aging. For these benefits to labor supply to materialize, as well as to favor social integration and maximize the contribution to the public finances, the integration of immigrants into the labor market is crucial.

Against this background, this study explores the labor market performance of immigrants in Germany in the past using micro-data from a large household survey, the German Socio-Economic Panel. To this end, it estimates empirical models of the determinants of wages, unemployment, and labor force participation, contrasting the outcomes of natives and immigrants. It provides a comprehensive overview of the labor market performance of immigrants and uses recent data, which contains an expanded immigrant sample. In addition, it highlights a new factor as an important driver of wage differences between natives and immigrants: the difficulty that immigrants experience to secure jobs that pay higher wages because they have a higher degree of “occupational autonomy,” e.g. jobs with managerial responsibilities. This finding provides new insights on the issue of immigrants’ skill downgrading in Germany.

The analysis shows that employed immigrants earn 20 percent less than employed natives with similar characteristics after arrival. Initially, immigrants’ wages catch-up by one percentage point per year, but the process slows down over time and wages never fully converge. Immigrants without German writing skills or a German degree have a wage gap as high as 30 percent initially. Good German writing skills close the gap by 10 percentage points and a German degree by another 5 percentage points. The latter finding shows that the benefit of experience in Germany is larger for those who arrive when they are still in education. The gap for immigrants born in advanced countries is a third of that of other immigrants. Half of the lower wages of immigrants results from lower levels of job autonomy (given other individual characteristics).

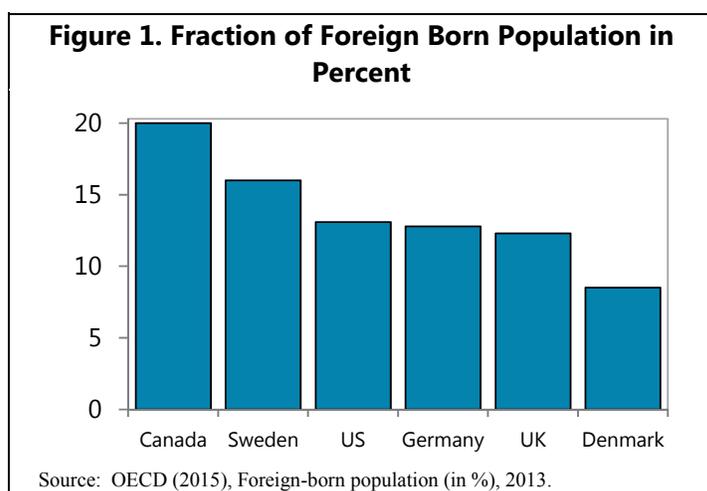
Turning to unemployment, the probability of being unemployed is initially 7 percentage points higher for recently arrived immigrants than for natives of similar characteristics. While the gap narrows over time, in the long-run the probability remains 3 percentage points higher. Again, German language skills and a German degree help closing the gap and immigrants from advanced countries perform better than other immigrants. While the participation rate of immigrants is also initially lower—with the expected effects of the immigrants’ characteristics—the participation rate converges fully after 20 years spent in Germany.

The rest of the paper is structured as follows. Section II provides an overview of immigration to Germany in general and the recent wave in particular. Readers only interested in the

empirical analysis of this paper may skip it. Section III briefly reviews the literature and Section IV presents the data. In Section V, I use some simple descriptive statistics to sketch out one of the main findings that is later established more formally. The empirical model for the analysis is described in Section VI. The next three sections report the results Section VII is on wages, Section VIII on occupational autonomy, and Section IX on unemployment and participation. Robustness checks are reported in Section X. Section XI concludes.

II. IMMIGRATION TO GERMANY—AN OVERVIEW

In Germany a very high fraction of the population is foreign-born. In 2013, over 10 million foreign-born persons lived in Germany, about 13 percent of the population. This share was very similar to the one in the U.S. and in the U.K., but smaller than in Sweden or Canada (Figure 1). However, 15 million Germans have had at least one foreign-born parent (Gathmann et al., 2014), which leads to a fraction of persons with a migration background—defined as having at least one foreign-born parent—as high as in Canada. In this section, I describe the population in-and-outflow to and from Germany from 1950 to 2015.



I rely on the official migration statistics of the German Federal Statistical Office (Destatis). These figures cover everyone who stays in the country for more than two months and hence include, for example, individuals who are in Germany for intra-company training programs, language study periods, seasonal jobs, and asylum applications. Only a fraction of all incoming immigrants actually remains in Germany. In the past, one third of all immigrants left the

country already within one year. As an example, of all Indians and Chinese nationals who arrived in 2006, less than one quarter was still in Germany in 2012, even though many of them came with working permits (Gathmann et al., 2014). For this reason, I also present statistics on permanent migration as measured by the OECD when I discuss some reasons for migration at the end of this section.

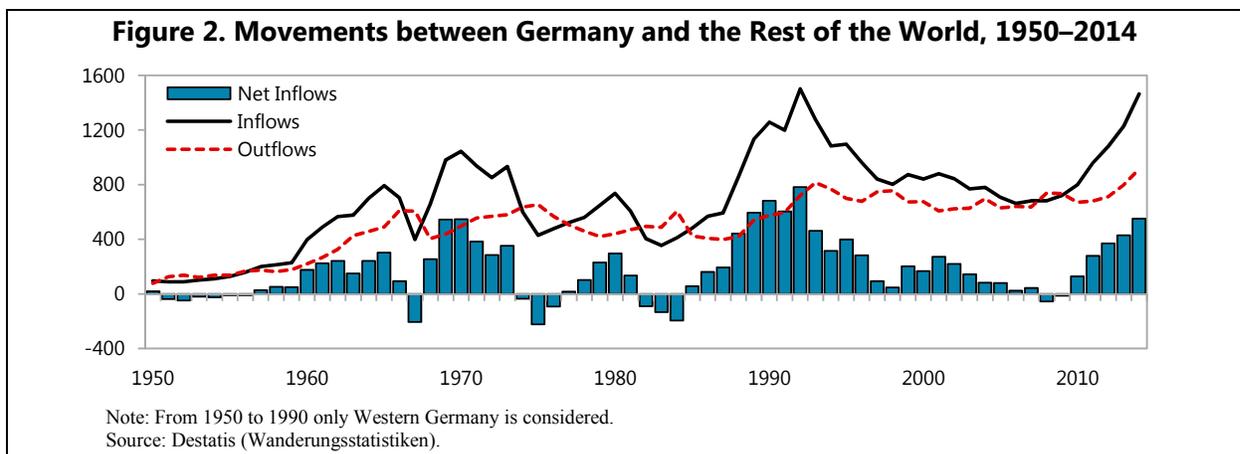
A. Inflows and Outflows from 1950 to 2015

Figure 2 plots inflows, outflows, and net immigration from 1950 to 2014. In the 1950s total movements were very low and net immigration was basically zero. However, rapid economic growth resulted in an acute shortage of labor by the middle of the decade, which led to recruitment agreements between Germany and Turkey and some Southern European countries beginning in 1955. Starting in 1960, Germany experienced the intended net immigration. The immigrants during this period originally came as “guest workers” rather than to settle permanently but many of them stayed in Germany. In 1973, when the economy

was hit by the first oil crisis, a recruitment ban on guest workers was imposed with exceptions only for highly skilled and seasonal workers. As a result, net inflows fluctuated around zero until the late eighties.

The second large migration wave was triggered by the fall of the iron curtain and the consequent large inflows in particular of ethnic Germans from Eastern Europe. In the early 1990s Germany experienced positive annual net immigration of more than 750,000 individuals. The inflows were thus slightly higher than the highest inflows during the first wave. In the second half of the 1990s, net immigration decreased slowly but steadily and after a small and temporary increase in the early 2000s turned negative right before the global financial crisis erupted in 2008.

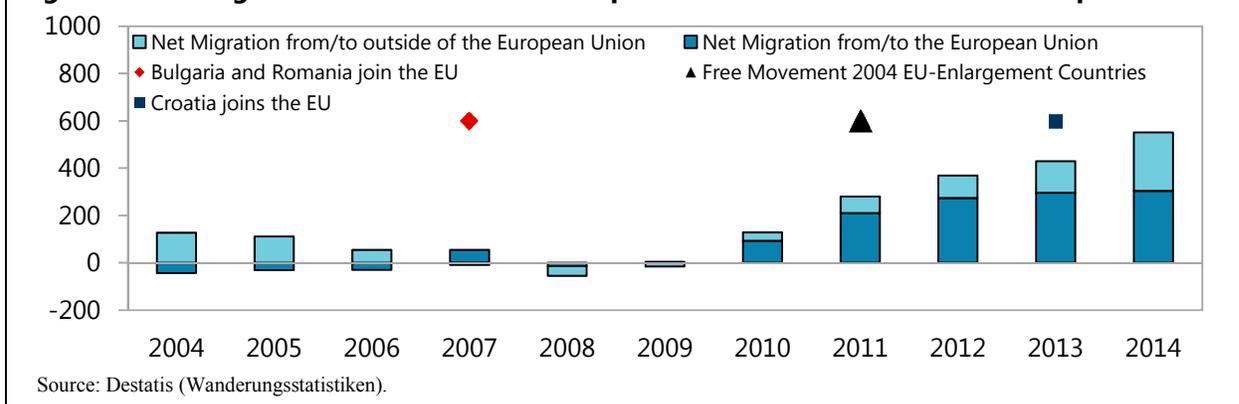
Since then, inflows have been increasing much faster than outflows¹ and net immigration in 2014 was above 550,000, i.e. 0.6 percent of the population. While this was already a high number, it was well below the peak reached in the early 1990s. However, in 2015 net immigration skyrocketed. Battisti and Felbermayr (2015) expect a net inflow of registered immigrants between 1.4 and 1.5 million. Net immigration could hence reach 2 percent of the population, which would constitute a new record.



B. Recent Inflows: Who are the New Immigrants?

Up until 2013, the post-crisis surge in net immigration to Germany consisted mainly of movements within the EU, which surpassed a quarter of a million people in 2012 (Figure 3). In 2014, net immigration from the EU surpassed 300,000. Net immigration from EU countries started to increase significantly in 2010 and 2011, both due to the financial crisis and due to lifting restrictions on immigration from countries that entered the EU in 2004 in May 2011. Inflows from Bulgaria and Romania, which joined the EU in 2007, also picked up, though restrictions on immigration from these countries to Germany were fully lifted only from 2014 onwards.

¹ Outflows are much less volatile than inflows but most of the time inflows and outflows are strongly correlated. Both show a clear upward trend from 1950 to 2014.

Figure 3. Net Migration from and to the European Union and outside of the European Union

While immigration from Southern Europe increased sharply, likely reflecting deep recessions and rising unemployment, total movements were not very large. However, even if most of the immigrants after the financial crisis came from Eastern Europe, their inflows have to a large extent resulted from the economic conditions in Southern Europe: with job opportunities vanishing in Southern Europe, perspective immigrants may have chosen instead to go to Germany. By controlling for the attractiveness of alternative destinations, Bertoli, Brücker, and Moraga (2013) argue that nearly 80 percent of the surge in immigration to Germany after the Global Financial Crisis resulted from diversion effects.

Since 2010, Germany is also experiencing positive and rising net immigration from outside the EU, reaching 150,000 in 2013 and 250,000 in 2014 (Figure 3). This reflects an increase in asylum applicants from 25,000 in 2008 to 130,000 in 2013 and to over 200,000 in 2014 (over 30 percent of all EU applications). In August 2015, the federal government updated its estimates for 2015 and now expects up to 800,000 new asylum applicants (BMI, 2015a).² However, already at the end of October more than 750,000 refugees were registered (BMI, 2015b) so that by the end of the year more persons will actually have arrived in Germany. For 2015 Battisti and Felbermayr (2015) expect similar inflows from within the EU than in 2014 and 1.1 million refugees from outside of the EU. The European Commission expects an additional inflow of 3 million refugees to the European Union until 2017, so that in Germany strong inflows are likely to persist for the years to come.

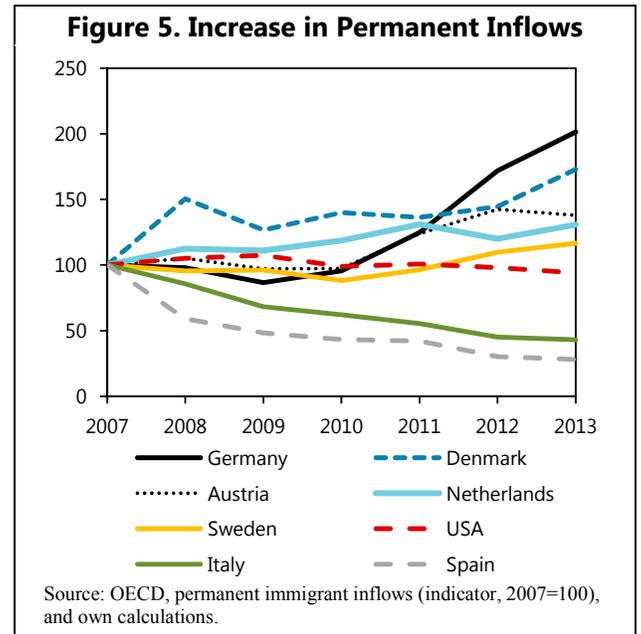
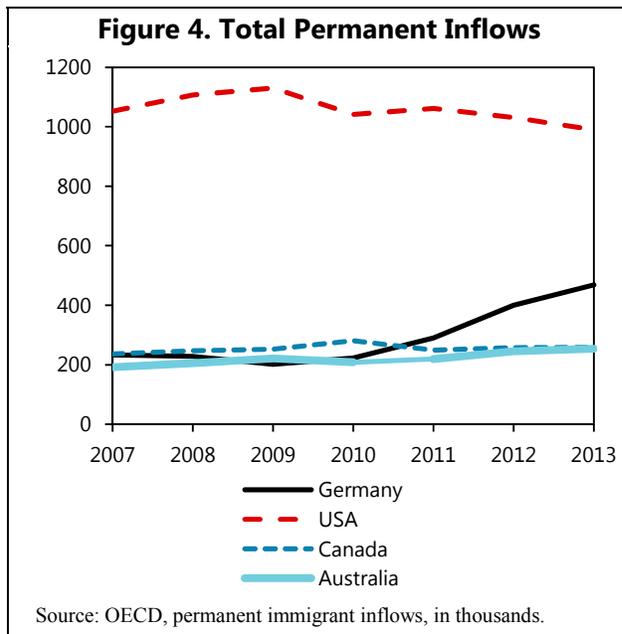
Summarizing, the new wave of immigration under way in Germany is rapidly changing: while it initially reflected mainly immigrants from new EU accession countries and, to a smaller extent, Southern Europe, the wave now consists to a large extent of asylum seekers from outside of the EU. From 2010 to 2013, immigrants from the EU accounted for roughly two thirds of total net immigration in each year. In 2014, net immigration from within the EU and from outside of the EU was nearly equally strong and in 2015 net immigration from outside of the EU was much higher than from within. As will be shown below, the

² This number does not refer to actual asylum applications (as the numbers before) but to immigrants newly registering to start an application. For some actual applications will not start before 2016 and others may leave Germany before an actual application starts.

characteristics of immigrants are very important factors in their labor market integration experience.

C. Reasons to Migrate

Only a fraction of all movements is directly related to employment. According to the special European Union Labour Force Survey of 2008, only half of all movements within the EU were triggered by reasons of employment (OECD, 2013). The fraction of immigrants coming from outside of the EU with a working permit is much smaller. In 2013 the residence status of only 12 percent of the incoming non-EU immigrant was linked to employment. The permanent labor immigration flows from outside the EU/EFTA relative to the population are very low compared to other OECD countries (OECD, 2013).³ More persons moved for studying and family unification. Another increasingly important motive is application for asylum. Immigrants to Germany enter under very different rules and regulations and labor market access is easier under some categories than under others (OECD, 2013).



Depending on the reason, migrants may only intent to stay temporarily or only have temporary permission to stay. As mentioned before, many migrants return already after short periods of time. It is therefore interesting to see whether the increase in net immigration described above is mirrored in permanent migration statistics. Permanent immigrant inflows are defined by the OECD as regulated movements which for the destination country can be considered as settling. They allow for a comparison of migration flows across countries.

³ Those who came were mostly highly-skilled men, mainly from Asia and in particular from India and China, and 90 percent of them moved to Western Germany.

Figure 4 shows the permanent inflows to Germany compared to the U.S., Canada, and Australia. From 2007 to 2010, Australia, Canada, and Germany had a very similar permanent inflow of around 200,000. From then on, permanent inflows remained constant in Australia and Canada but doubled in Germany. The strong increase in immigration discussed in the previous section is hence mirrored in the permanent migration statistics. With over one million immigrants, the U.S. still attracts by far the highest permanent inflows.

Figure 5 compares Germany with other European countries. Immigration also increased in Denmark, Austria, the Netherlands, and Sweden, but less so than in Germany, while Italy and Spain experienced decreasing inflows throughout the period.

III. LITERATURE REVIEW

There is a very large literature on the labor market performance of immigrants, which this paper cannot comprehensively survey. However, some findings particularly important for the analysis are described below.

Since Chiswick (1978), it is known that in the U.S. immigrants start with much lower wages than natives with similar characteristics and then slowly catch up. Adsera and Chiswick (2007) show the same for 15 European countries. The initial wage penalty is often interpreted as devaluation of human capital obtained in another country (e.g. Chiswick and Miller, 2009). Over time, immigrants' wages converge to those of natives as immigrants invest in human capital and find jobs with higher earnings, a better fit, or in higher-paying industries and occupations. In addition, employers over time learn about the true productivity of the immigrants. There is some evidence that immigrants even overtake natives after 10 to 15 years in the U.S. and Canada (Chiswick, 1978; Meng, 1987). The reason could be that immigrants are a self-selected group with potentially higher levels of labor market ability and motivation. Chiswick, Cohen, and Sachs (1997) report an initially higher unemployment rate and lower participation rate of immigrants in the U.S. but a fast assimilation of these rates.

In Germany, on the other hand, there is no clear evidence of wage convergence even of workers with similar characteristics suggesting that labor market integration is more difficult than in the U.S. or Canada. While some papers find a catching-up process (Constant and Massey, 2005; Gundel and Peters, 2007, Büchel and Frick, 2004, Lehmer and Ludsteck 2011, 2014), others do not (Pischke, 1992, Dustmann 1993, Schmidt, 1997; Bauer et al. 2005). Regarding unemployment, Kogan (2005) shows that immigrants in Germany are more likely to be unemployed and that the higher risk of unemployment is only partially related to their lower human capital but results also from their unfavorable labor market allocation.

Another crucial discussion is related to the immigrants' skill downgrading in the receiving country. This can either mean that immigrants in the destination country do jobs that require less qualification than the job they did in the home country (Akresh, 2008) or that immigrants—given other characteristics and, in particular, education levels—perform worse than natives in the destination country. Using the latter definition, Dustmann et al. (2013) show that immigrants in the U.K., conditional on education, tend to work in jobs with a lower socio-economic classification than natives.

Finally, many papers have analyzed the effect of language skills on the earnings of immigrants. Dustmann and van Soest (2001, 2002), Aldashev, Gernandt, and Thomsen (2009) and Zibrowius (2012) all confirm that German language skills reduce the wage penalty of immigrants.

IV. DATA

A. The German Socio-Economic Panel

This analysis is based on the German Socio-Economic Panel (GSOEP), which is a representative household survey located at the German Institute for Economic Research (DIW) in Berlin. The survey started in 1984 with around 12,000 participants. This number doubled over time and 24,000 individuals were interviewed for the most recent wave in 2013. The panel is organized on a household basis but all participants aged at least 16 years are personally interviewed. It is the largest survey of immigrants in Germany and it oversamples the immigrant population. In 2013 an additional immigrant sample of 5000 persons was added. The new immigrants are sampled using the 2011 census to take into account compositional changes since 1995. To the best of my knowledge, this is the first paper that uses the 2013 data in an analysis of immigrant labor market performance.

B. The Dependent and Control Variables

I include the following variables that are either taken directly from the survey or constructed from other variables included therein:

Labor Force Status. Each person is either working, or unemployed, or not part of the labor force.

Hourly Real Wages. I transform both monthly gross and net nominal wages into hourly gross and real wages using the actual working hours per week. In the baseline I use the wages before taxes (gross wages) but net wages are analyzed as well.⁴

Education. I restrict education to three categories, which are defined using the highest degree or diploma obtained according to the ISCED-1997 classification. I define ISCED-1 and ISCED-2 as “low”, ISCED-3 and ISCED-4 as “medium”, and ISCED-5 and ISCED-6 as “high” education. Low education will always be the benchmark.

Region. A dummy for persons living in Eastern Germany is included.

Working and Unemployment Experience. I include both the years of full-time work experience and years of unemployment experience.

⁴ The typical caveats are in place: as respondents report their earnings on a monthly basis but working hours on a weekly basis, measurement errors for calculated hourly wages may arise especially at the bottom of the wage distribution (Müller, 2009). Moreover, there are problems of missing information or incorrect values for self-reported income (Falck et al., 2013).

Years Spent in Firm. This variable measures the time spent with the current employer in years.

Job that Requires High Qualification. This dummy is one when the job requires a degree from a college or university and zero otherwise.

Autonomy Status of the Job. This is a measure specifically designed for the GSOEP. It measures the autonomy level of the occupational activity and groups jobs on a scale from 1 (low) to 5 (high) based on task descriptions, level of responsibility, training required, and company size. Unspecialized manual labor is in the “low” category; farm work and production and services that require at least minimal specialization are in the “low-medium” category; jobs that require middle track of secondary school and involve some responsibility as well as self-employed without any employees are in the “medium” category; work that requires college and self-employed work with some employees is in the “medium-high” category; and managers, freelance academics and self-employed with many employees are in the “high” category. The autonomy level is strongly correlated with the wage; a one-level step in the job autonomy scale is associated with an average wage increase of 20 percent. For more details regarding this variable and how it compares to other international job classifications and rankings see Hoffmeyer-Zlotnik and Geis (2003).

Industry. I include ten categories for the industry in which a person is working. The categories are Agriculture, Energy, Mining, Manufacturing, Construction, Trade, Transport, Bank and Insurances, Services, and Others.

Being Trained for Job. Survey participants are asked whether they are working in the occupation they have been trained for. I include three possible values: “yes”, “no”, and “no training”. Not working in an occupation one is trained for is the omitted category.

Immigrant. This dummy is zero for all persons born in Germany and one for those not born in Germany. Hence immigrants are defined by foreign birth.⁵

In addition, I include the *Age*, the *Gender*, whether a person is *Married* and for those working whether they do a *Full-Time Job*. Finally, I add some variables specific to the immigrants. These variables are:

Years Since Immigration. This is calculated as the difference between the survey year and the year of arrival in Germany. This variable is a proxy for the experience gained in the country and opportunities for social integration. I also use the squared number of years in order to account for possibly non-linear effects.

German Degree. From the information in the survey, I can construct a dichotomous variable that is one when the immigrant obtained a degree in Germany, and zero otherwise.

⁵ Büchel and Frick (2004) confirm that foreigners born in Germany are generally very similar to natives.

Born in Advanced Country. The GSOEP contains information on the country of birth of the immigrant. I group countries in advanced and non-advanced based on the IMF classification. Immigrants from advanced countries may have better alternative options if they do not find good jobs in Germany relative to immigrants from other countries.

German Writing Skills. I use information in the survey to construct a dummy that is one if an immigrant has good or very good German writing skills. As this variable has many missing observations, a third category for missing values is included.

C. Sample and Data Modifications

The original sample uses all 35 vintages from 1984 to 2013 and has 502,000 observations. For the empirical analysis, the sample is restricted to persons between 16 and 70 years old, resulting in a loss of 70,000 observations. Observations are only lost for those years, in which the person is not in the considered age group. I also drop observations with unknown place of birth (2,000), immigrant with unknown year of arrival in Germany (3,000), those for whom it cannot be identified where they obtained their degree (10,000), those who are in education, have already retired, or are in maternity leave (54,000), those with unknown education (3,000) and those for which the individual sample weight is zero (7,000). This leaves 350,000 observations.

For the analysis of the wage performance, I also drop persons who are not working (79,000), for whom the required job training is unknown (7,000), who worked less than 10 hours a month, who did not report positive wages and for whom real wages cannot be computed⁶ (together 28,000), those for whom the time spent in the firm and the occupational autonomy are unknown (together 1,000) and those with an occupational autonomy below one (12,000).⁷ This leaves 224,000 observations.

I transform monthly nominal gross earnings into hourly real wages and replace wages below the 5 percent and above the 99 percent percentile with the respective value of the percentile in that year. For experience, training, industry, and language proficiency I also add dummies for missing values.

Table A1 in the Appendix reports the minimum, mean and maximum for all variables for the full sample and for the survey year 2013. Here I shortly review the data for 2013, as it is more interesting to understand today's populations in contrast to an average of all the years. In 2013, natives were on average 44.9 years old and immigrants with 43.7 years a little younger. The fraction of women was 50 percent and 51 percent respectively. More natives had medium and high education than immigrants. However, of those who migrated after 2007, the fraction of highly educated was considerably higher than in the native population. The fraction of unemployed was 6 percent among the natives but 10 percent among the immigrants, while the participation rate was only slightly lower among the immigrants. Three

⁶ This refers to East German wages in 1990.

⁷ Category 0 is for apprentice, interns and unpaid trainees.

out of four immigrants were able to speak good or very good German and nearly two thirds had good or very good German writing skills. A little over a third of the immigrants obtained an educational degree in Germany and on average they had been in Germany already for 22.5 years.

Table A2 in the Appendix looks closer at the working population and shows that while the working experience is similar, immigrants spent on average more time unemployed, namely 1.1 years versus 0.6 years. Immigrants were less likely than natives to have a job for which they were trained (41 percent versus 59 percent) and less highly skilled immigrant than natives had a job that required high education (14 percent versus 22 percent). Finally, the occupational autonomy of immigrants was also lower than that of natives (2.2 versus 2.8).

Total Population			Women			Men		
Hourly Real Wage		Gap	Hourly Real Wage		Gap	Hourly Real Wage		Gap
Natives	Immigrants		Natives	Immigrants		Natives	Immigrants	
15.0	12.7	15.3 %	13.4	11.0	17.9 %	16.5	14.3	13.3 %
(0.10)	(0.24)		(0.15)	(0.34)		(0.20)	(0.18)	

Source: GSOEP 2013, own calculations

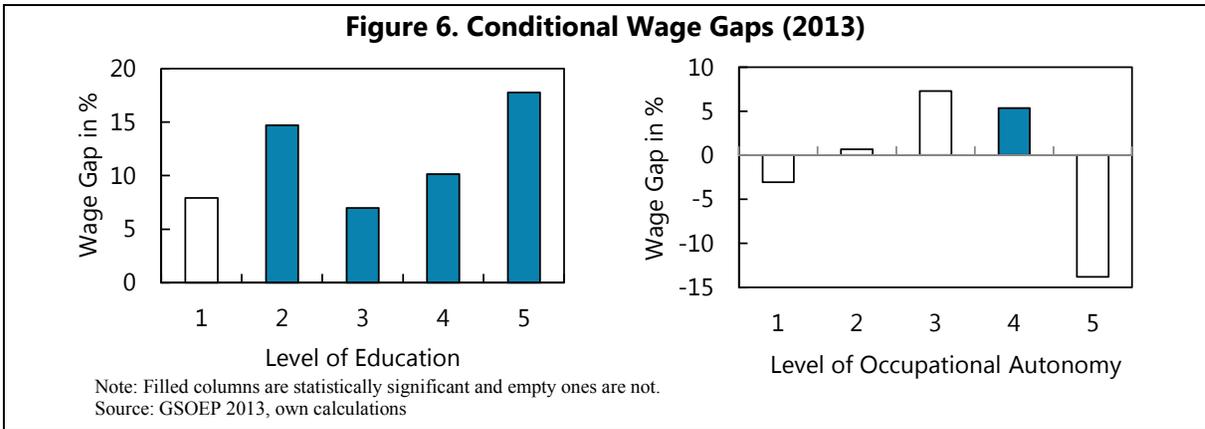
Table 1 shows the raw wage gaps of natives and immigrants separately for the total population, women and men. On average a working native in 2013 earned 15.0 Euros per hour and an immigrant earned on average 12.7 Euros per hour. The unconditional wage gap is hence 15.3 percent. It is much larger for women than for men. These raw wage gaps do not take into account the different characteristics of natives and immigrants. I just discussed some of them that obviously influence wages, with the most obvious one being education. Table A4 in the Appendix shows the educational distribution of natives and immigrants. The latter are separated according to years of arrival and origin. In general, natives are better educated than immigrants, but for those who arrived after 2007 it is the other way round: 55.7 percent of those from advanced countries and 28.5 percent of all others had high education, while for natives the fraction is only 22.1 percent. However, also the fraction of very low educated is higher among immigrants. Their educational distribution is much more dispersed than that of natives.

V. CONDITIONAL WAGE GAPS AND DOWNGRADING OF IMMIGRANT SKILLS— A FIRST GLANCE

In this section I use the 2013 survey and some simple descriptive statistics in order to point out some of the most striking results established more formally in the next section.

The left panel of Figure 7 shows the wage gap of natives and immigrants (in percent) by level of education according to the ISCED classification, where the last category combines

ISCED-5 and ISCED-6.⁸ The filled bars show statistically significant gaps.⁹ The figure shows that even conditional on education natives still earn more than immigrants. The gap for very low education is not significant because there are very few natives with such a low education.



Interestingly, in contrast to education, the wage gaps vanish when conditioning on occupational autonomy, as can be seen in the right panel of Figure 6. Not only are the wage gaps insignificant, but for two out of the five categories immigrants even earn more than natives and for one category the gap is basically zero. There is a significant positive gap only for the medium-high autonomy category, which could be related to the particular German apprenticeship system. The comparison of the two panels suggests, first, that given the kind of job immigrants and natives do there is no more wage gap and, secondly, that immigrants with the same education do not have jobs of the same occupational autonomy as natives. The pattern can be explained by skill downgrading of immigrants.

Figure 7 visualizes the skill downgrading of immigrants. It reduces the five education levels to three as described in the data section. It shows for each of the categories the frequency of the different levels of occupational autonomy separately for natives and immigrants. Note that the natives' curve is shifted to the right in all panels. That means that for all three categories there is a higher fraction of natives with medium-high and high autonomy and a lower fraction with low and medium-low autonomy. Hence immigrants with the same education do not manage to perform as well on the autonomy scale as natives.

The level of occupational autonomy is strongly correlated with wages and going up one level increases the wage on average by 20 percent. Skill downgrading of immigrants, therefore, has the potential to explain some of the wage gap observed before. Clearly, the skill downgrading does not necessarily result from discriminatory preferences, as it may reflect other characteristics of immigrants that have not been controlled for. Immigrants without language skills, for example, cannot be expected to take over responsibility and management

⁸ Table A4 in the Appendix reports the actual wages of natives and immigrants as well as the frequency of each education and autonomy level in each subgroup.

⁹ The gap for education 2 and 5 are significant at the 1 percent level, for 4 at the 5 percent level and for 3 at the 10 percent level. The gap for occupational autonomy 4 is significant at the 5 percent level.

duties to the same extent as a native. Another factor could be a different quality of the educational degrees obtained in Germany and abroad. These are variables that I will consider in the formal analysis in the next section.

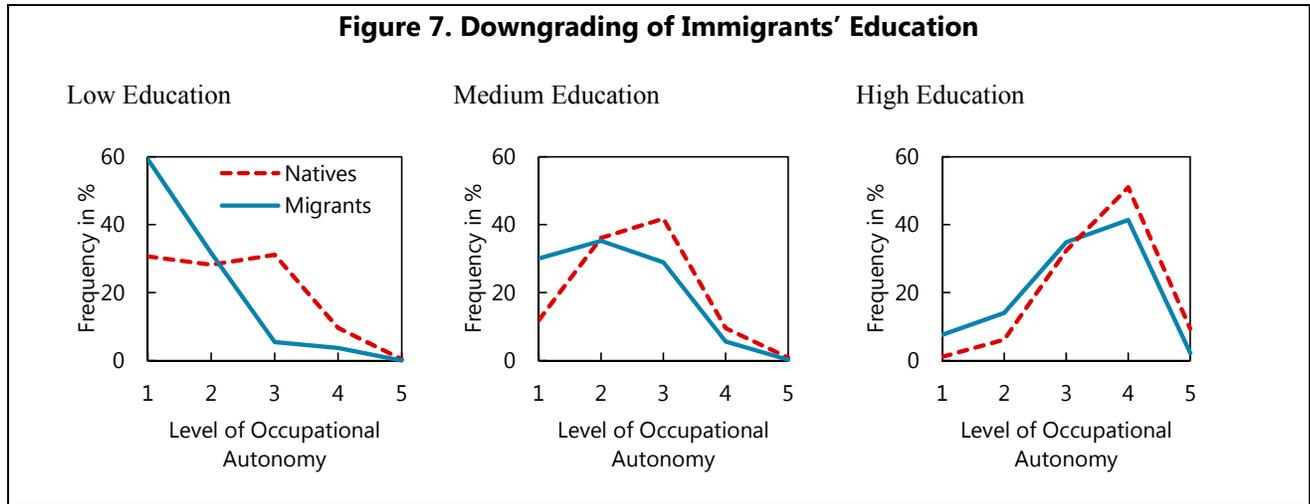


Table A5 in the Appendix reports summary statistics for the full sample as well as separate statistics for immigrants who arrived before 1990 and for those who arrived after 2007. While the former are less disadvantaged than the rest of the immigrants, significant differences remain. It is interesting (and a source of concern) that recent immigrants perform particularly badly: in this group, one out of four highly educated immigrant has a job with low or low-medium autonomy, while the same is true for only one out of 14 natives.

VI. THE EMPIRICAL MODEL

In the following I estimate Mincer-type wage equations, autonomy equations, as well as unemployment and participation equations. In general, all estimated models have the following structure:

$$x_{it} = \beta_1' E_{it} + \beta_2' M_{it} + \beta_3' C_{it} + \varepsilon_{it},$$

with x_{it} being either the natural logarithm of the hourly real wage, the autonomy level, or a dummy for being unemployed or part of the labor force; E_{it} being a vector of all explanatory variables common to immigrants and natives; M_{it} containing the variables specific to the immigrants, which are all estimated as interaction terms; C_{it} comprising the controls, whose coefficients are not reported; and ε_{it} is an error term.¹⁰

¹⁰ On the one hand, including dummies is important, because they explain differences between immigrants and natives. On the other hand, they may themselves be governed by discriminatory preferences and hence hide some of the differences. Two typical caveats of such an analysis are, first, that some variables like language skills both affect and are affected by the labor market outcomes and, second, that different immigrant groups may have self-selected on basis of included variables like industry or education. As long as these effects are not too important, the potential bias is small. Nevertheless, they make a causal interpretation of the results difficult.

Depending on the specification, I estimate OLS, logit or ordered logit models. As persons are in the survey for many consecutive years, I cluster standard errors on the individual level in order to account for individual error correlation. All models are estimated using the individual sample weights. In Section X I discuss the robustness of the results using no sample weights, probit instead of logit models, a Heckman selectivity correction, and a random-group variance estimator.

VII. MINCER-TYPE WAGE EQUATIONS

In all of the following specifications I use the natural logarithm of the hourly real wage before taxes as the dependent variable. Since estimation is done in natural logarithms, coefficients can be interpreted as marginal effects in percent. As controls in all of the following wage equations I use the region, whether a person is married, works full time, the age, the number of years in the firm, as well as year and industry dummies. The models are estimated with all 224,000 observations.¹¹

A. Baseline

First, I only include the years of experience, the years of experience squared in order to account for non-linear effects, and dummies for medium education, high education as well as for being an immigrant. Results are presented in the first column of Table 2. As expected, wages increase with experience; one additional year raises wages by close to 2 percent at the beginning, but with increasing experience the benefit from additional years becomes smaller and after 20 years the additional benefit is basically zero. Persons with medium education earn 11 percent more than those with low education and those with high education earn 40 percent more. The female wage gap is 12 percent. This regression tells us the wage gap of natives and immigrants conditional on experience and education (and the controls). Remember that the raw wage gap was 15.3 percent and note that being an immigrant now reduces the wage by 7.3 percent. Hence roughly half of the gap observed before can be explained by the few characteristics included in the first specification. Compared to similar regressions the R-squared of 34 percent is very high.

B. Differentiating among Immigrants

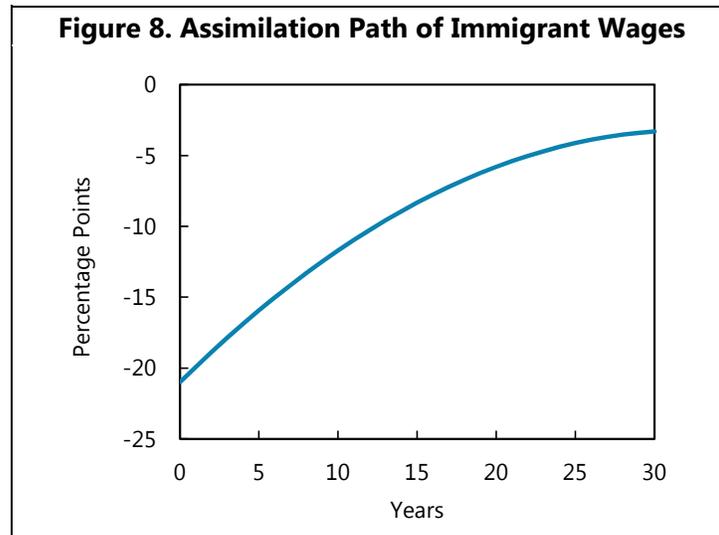
Next I differentiate among the immigrants, who are a very heterogeneous group. The number of years spent in Germany, for example, varies from zero to 60 years. And, as mentioned before, roughly two-thirds of the immigrants have good or very good German writing skills, but the others do not. Other differences include the country of origin and whether immigrants come as students and obtain a German degree, or not.

Evidence for Assimilation

As is standard in the literature, see e.g. Borjas (1999), I estimate assimilation by including the years since arrival in Germany as a proxy for the experience acquired in Germany and a

¹¹ Cross-correlations are reported in Table A7 and Table A8 in the Appendix.

squared term as well in order to account for non-linear effects¹². The second column in Table 2 shows the regression output and Figure 8 plots the assimilation path. Immigrants arriving in Germany face an initial wage gap of 21 percent and catch-up by roughly 1 percentage point every year. However, with more years spent in Germany assimilation slows down and eventually stops before it is fully complete.



German Language Skills and German Degrees

Next, I include interaction terms for immigrants with good or very good German writing skills and for those with a German degree.¹³ With this set-up, it is possible to test whether there is an additional benefit from schooling in Germany beyond better language skills.

The third column in Table 2 shows the results. The wage gap increases to over 30 percent for those without any beneficial characteristics. Good German writing skills close the gap by 10.0 percentage points and having a German degree decreases the gap by an additional 5.4 percentage points.¹⁴ It is not surprising that German writing skills improve the immigrant's productivity and therefore also the wage. The additional effect from a German degree could result either from a superior quality of education in Germany compared to that in immigrants' origin countries or from specific skills or information necessary to perform well on the German labor market that are transferred only in German schools. Examples could be career orientations or application trainings. Interestingly, writing German well and having a German degree alone are not sufficient for an immigrant to earn a wage similar to that of a comparable native. In order to earn the same wage an immigrant needs in addition to spend 25 years in Germany. That result is different from Aldashev, Gernandt, and

¹² I also added a third-order polynomial but the respective coefficient is insignificant.

¹³ Using oral skills instead of writing skills results in similar but somewhat weaker effects. While there is a high correlation between the two, more people speak well than write well.

¹⁴ One could imagine that years of experience in the destination country are more valuable for young immigrants, as they may find it easier to adapt. However, I do not find any evidence in that regard.

Thomson (2008), who argue that immigrant-native wage differences for all those who completed their education in Germany are very small.

Region of Origin and the Most Recent Immigrant Wave

As an additional test, I add a dummy for immigrants born in advanced countries. These immigrants very likely have better outside options than immigrants from other countries and therefore could have smaller wage gaps. It may also be that immigrants from advanced countries face smaller cultural barriers or less discrimination; finally, their education may be better (for any given degree) than that of other immigrants. In fact, the regression results in the fourth column of Table 2 show that the gap of those born in advanced countries is one third smaller than that of other immigrants of similar characteristics. I test for additional effects for immigrants from emerging Europe¹⁵ and from the most important origin countries of recent asylum seekers¹⁶ and do not find any difference to immigrants from other non-advanced countries. Note, however, that this may be due to the fact that there are only few observations for these subgroups, in particular for immigrants from the latter countries.

Moreover, I include a dummy for the most recent immigrant wave in order to see if their labor market experience differs from that of past waves. One reason could be the higher wage flexibility of the German labor market compared to previous periods which could allow firms to hire new immigrants at lower wages. Those who arrived after 2007 have indeed a large additional gap of 17 percentage points. Note that including the dummy has minimal effects on the coefficients of other immigrants' characteristics, which may be because only a small fraction of all migrants arrived after 2007.

C. The Channels

In the following I add more observables in order to understand better the channels that may explain the immigrants' wage gap. Immigrants on average spend more time in unemployment than natives and, if time spent in unemployment has a permanent negative wage effect for workers in general, this could contribute to the gap (Davis and von Wachter, 2011). In fact, as can be seen in the sixth column of Table 2, every year of unemployment lowers the wage by 3.5 percentage points. However, when including the unemployment experience, the coefficient on the immigrant dummy decreases only very little. Differences in time spent in unemployment explain less than 10 percent of the immigrants' wage gap.

Another factor that may help explain the wage gap of immigrants is that natives are more likely to work in a job which they are trained for. If being trained for a job has wage benefits, this may explain part of the gap. The results are presented in the seventh column of Table 2. As expected, I find a positive effect, but including this variable in the regression does not alter the immigrant coefficients much and also explains less than 10 percent of the gap.

¹⁵ Poland, Hungary, Bulgaria, Romania, Croatia, Russia, Ukraine, Latvia, and Lithuania.

¹⁶ Syria, Albania, Kosovo, Afghanistan, and Iraq.

Next, I add the job autonomy variable that has been described in detail in the data section. Even when controlling for so many worker characteristics, going up one level in the autonomy scale increases the wage on average by 13 percentage points. Note that when the autonomy level is included some (but not all) of the coefficients of the other explanatory variables become smaller. While the effect from years of experience and being a woman remains nearly the same, the returns to education and the effect of being an immigrant are halved. Hence, half of the effect of education on wages seems to result from the fact that better educated workers obtain jobs with a higher degree of autonomy. And some of the immigrants' wage gap seems to stem from the fact that immigrants, even when their other characteristics are identical, do not do the same jobs as natives. This finding is consistent with evidence of imperfect substitutability between immigrants and natives that have the same education and experience (Ottaviano and Peri, 2012).

Interestingly, the effect of good German writing skills and a German degree now become insignificant, suggesting that these skills help push up the wage by allowing the immigrant to access jobs with a higher degree of autonomy. This result is in line with Aldashev et al. (2009), who argue that language skills increase wages only indirectly due to economic sector and occupation. Including the occupational autonomy increases the R-squared of the regression from 35.4 percent to 39.4 percent.

D. Different Returns to Education

Finally, I am raising the question whether, once autonomy is included and hence the quality of the job is controlled for, immigrants and natives have the same returns to education, or not. To do so, I first add an interaction term for the two education dummies. Column 9 in Table 2 shows the results. I find only very weak evidence that medium educated immigrants benefit less from education than natives, but strong evidence for a lower return to high education. In a next step, I differentiate among those who have high education and a job that requires high education, i.e. I control for high quality job matches. The results in the last column show that a native with a high education job match earns 22 percent more than one without a match.¹⁷ And, if at all, having a match has an even greater advantage for immigrants. The different returns to high education are therefore caused by those without a job match. Over-education results in a higher wage for natives but not for immigrants.¹⁸ This result relates nicely to Anastassova (2010). She shows that in Germany, first, the returns to the usual years of education for an occupation are the same for natives and immigrants, and, second, that years of education above the 'typical' years have a larger positive impact on the earnings of natives than on those of immigrants. There is evidence, on the other hand, that over-education is compensated similarly in the U.K. (Lindley and Linton, 2006) and the U.S. (Chiswick and Miller, 2008).

¹⁷ Estimating a stochastic earning frontier with GSOEP data for 2000, Lang (2005) finds as well that an academic degree shifts up the wage up by around 12 percent and by 20 percent for jobs requiring an academic degree.

¹⁸ See Hartog (2000) and McGuinness (2006) for in depth studies of over-education.

E. Other Results

To test whether other worker characteristics have differential effects on wages across the two populations, I estimate a model that includes interaction terms between the immigrant dummy and all explanatory variables. I find significant but quantitatively very small differences regarding working and unemployment experience. Importantly, the effects of being trained for a job and job autonomy are identical for immigrants and natives. Another difference is worrying and deserves more attention. The wage gap for female immigrants is 50 percent larger than the gap for native women, suggesting that immigrant women face substantial barriers in the job market.¹⁹

A distinction between migrants of the three different waves would be interesting. Unfortunately there are not enough observations to study immigrants from the most recent wave separately (in addition to including a shift of the constant, as done in Section B above). Instead, I divide the immigrants into those who arrived before 1990 and those who arrived thereafter. The gap for immigrants with good German writing skills and a German degree is the same for both groups. However, language skills and to an even larger extent a German degree are significantly more important for later immigrants. As a consequence the wage gap for immigrants without good language skills or a German degree is larger for those who arrived later. One obvious reason for the finding is the changing nature of jobs in recent decades and the loss of many old manufacturing jobs that provided a relatively good income for many low skilled immigrants.

Finally, as an additional test, I replace gross wages with net wages and find, as expected, that the returns to education and the immigrant wage gap are smaller. The reason is, of course, that immigrants are concentrated in the lower part of the wage distribution and hence tend to benefit from Germany's progressive income tax system. Interestingly, the female wage gap increases considerably when measured by net wages. The increase is fully driven by married women, whose gap increases strongly.

¹⁹ Research on wages and in particular on the wage gap between immigrants and natives considers mostly men only; two of the few exceptions are Dustmann and Schmidt (2000) and Adsera and Chiswick (2007).

Table 2. Mincer-type Wage Regression Output

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Experience	0.019*** (0.00089)	0.019*** (0.00089)	0.019*** (0.00089)	0.019*** (0.00089)	0.019*** (0.00089)	0.019*** (0.00088)	0.019*** (0.00087)	0.018*** (0.00082)	0.018*** (0.00082)	0.019*** (0.00081)
-										
Experience Squared	0.00044** *	-0.00043***	-0.00044***	-0.00044***	-0.00044***	-0.00044***	-0.00044***	-0.00041***	-0.00040***	-0.00041***
	(0.000019)	(0.000019)	(0.000019)	(0.000019)	(0.000019)	(0.000019)	(0.000018)	(0.000017)	(0.000017)	(0.000017)
Medium Education	0.11*** (0.0075)	0.11*** (0.0075)	0.11*** (0.0075)	0.11*** (0.0075)	0.11*** (0.0075)	0.073*** (0.0076)	0.065*** (0.0075)	0.035*** (0.0070)	0.041*** (0.0079)	0.045*** (0.0079)
Immigrant with ME									-0.025* (0.014)	-0.022 (0.014)
High Education	0.40*** (0.0094)	0.40*** (0.0094)	0.39*** (0.0095)	0.39*** (0.0094)	0.39*** (0.0094)	0.35*** (0.0094)	0.32*** (0.0094)	0.18*** (0.0093)	0.19*** (0.0100)	0.10*** (0.011)
Immigrant with HE									-0.087*** (0.022)	-0.085*** (0.024)
HE Job Match										0.22*** (0.010)
Immigrant with HE JM										0.060* (0.033)
Female	-0.12*** (0.0068)	-0.12*** (0.0068)	-0.12*** (0.0068)	-0.12*** (0.0068)	-0.12*** (0.0068)	-0.13*** (0.0067)	-0.13*** (0.0067)	-0.12*** (0.0062)	-0.12*** (0.0062)	-0.11*** (0.0061)
Unemployment Exp.						-0.035*** (0.0021)	-0.033*** (0.0020)	-0.025*** (0.0019)	-0.025*** (0.0019)	-0.024*** (0.0019)
Trained for Job							0.087*** (0.0051)	0.028*** (0.0049)	0.028*** (0.0049)	0.021*** (0.0048)
Autonomy (Job Type)								0.13*** (0.0030)	0.13*** (0.0030)	0.11*** (0.0030)
Immigrant	-0.073*** (0.0085)	-0.21*** (0.028)	-0.32*** (0.030)	-0.33*** (0.030)	-0.31*** (0.031)	-0.29*** (0.031)	-0.27*** (0.031)	-0.16*** (0.029)	-0.12*** (0.031)	-0.12*** (0.030)
Years in Germany		0.011*** (0.0027)	0.011*** (0.0026)	0.010*** (0.0027)	0.0094*** (0.0027)	0.0099*** (0.0027)	0.0090*** (0.0027)	0.0074*** (0.0024)	0.0064*** (0.0025)	0.0068*** (0.0024)
YiG Squared		-0.00018*** (0.000060)	-0.00018*** (0.000059)	-0.00020*** (0.000060)	-0.00019*** (0.000061)	-0.00019*** (0.000060)	-0.00018*** (0.000060)	-0.00015*** (0.000054)	-0.00013** (0.000054)	-0.00014*** (0.000053)
Good German Writing			0.10*** (0.020)	0.11*** (0.020)	0.10*** (0.020)	0.089*** (0.020)	0.085*** (0.020)	0.052*** (0.019)	0.064*** (0.019)	0.051*** (0.018)
German Degree			0.054*** (0.014)	0.058*** (0.014)	0.057*** (0.014)	0.044*** (0.014)	0.040*** (0.014)	0.00093 (0.013)	0.0057 (0.013)	0.0060 (0.013)
Born in Adv. Country				0.11*** (0.018)	0.11*** (0.018)	0.096*** (0.018)	0.094*** (0.017)	0.063*** (0.015)	0.065*** (0.015)	0.052*** (0.015)
Migrated after 2007					-0.17*** (0.058)	-0.18*** (0.058)	-0.17*** (0.056)	-0.18*** (0.055)	-0.17*** (0.055)	-0.17*** (0.057)
Observations	224,272	224,272	224,272	224,272	224,272	224,272	224,272	224,272	224,272	224,272
R-squared	0.336	0.336	0.337	0.338	0.338	0.348	0.354	0.394	0.394	0.407
Controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Controls: region, married, working full time, the age, the number of years in the firm, as well as year and industry dummies.

VIII. DETERMINANTS OF JOB AND AUTONOMY MATCHES

In the previous section it became clear that the occupational autonomy variable is crucial in explaining the lower wages of immigrants in Germany. The autonomy level is itself a labor market outcome and it is therefore important to understand why immigrants with the same education are doing jobs with less autonomy. Reasons for this kind of skill downgrading could be outright discrimination, details of the labor market institutions, such as the ease of converting educational degrees, or the role of networks. Skill downgrading is closely connected to the imperfect substitutability of immigrants and natives. The underlying reasons hence provide insights on the segmentation of the labor market as well. While the following analysis cannot resolve this issue fully, it contributes to a better understanding by examining the determinants of the autonomy level.

I first estimate an ordered logit model with the level of autonomy as the dependent variable. Table 3 reports the average marginal effects for the different levels of autonomy. Accordingly, based on the estimated coefficients, an immigrant is on average 30 percent more likely than a native to have a job with low autonomy conditional on the other included variables. As for wages, the “immigrant penalty” becomes smaller over time, but assimilation is minimal: after 20 years the average marginal effect from being an immigrant is still 23 percent. Only an immigrant who writes German well, has a German degree, and is born in an advanced country has a probability as low as a native to obtain a job with a low level of autonomy. Looking at high autonomy, immigrants are 9 percentage points less likely to have high autonomy job and, again, the effect remains strong over time. Immigrants with a German degree and writing skills and those born in advanced countries perform better than other immigrants.

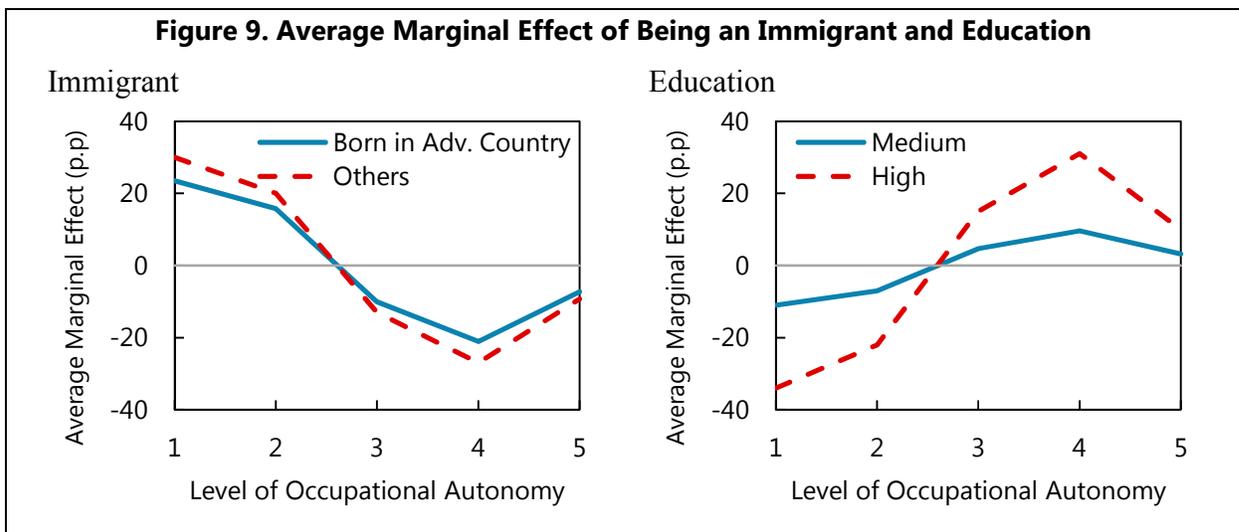
Table 3. Average Marginal Effects for Level of Occupational Autonomy

Occupational Autonomy	Low	Low-Medium	Medium	Medium-High	High
Immigrant	0.30***	0.20***	-0.14***	-0.27***	-0.092***
Years in Germany	-0.0051***	-0.0033***	0.0023***	0.0045***	0.0016***
YiG-Squared	0.000081**	0.000052**	-0.000036**	-0.000072**	-0.000025**
Arrived after 2007	-0.030	-0.019	0.013	0.026	0.0090
Born in Advanced Country	-0.063***	-0.041***	0.028***	0.057***	0.019***
Good German Writing Skills	-0.12***	-0.075***	0.052***	0.10***	0.036***
German Degree	-0.10***	-0.067***	0.046***	0.092***	0.032***
Medium Education	-0.10***	-0.067***	0.046***	0.093***	0.032***
High Education	-0.34***	-0.22***	0.15***	0.30***	0.10***
Experience	-0.0055***	-0.0036***	0.0025***	0.0050***	0.0017***
Experience Squared	0.00010***	0.000066***	-0.000046***	-0.000092***	-0.000031***
Female	0.047***	0.030***	-0.021***	-0.042***	-0.014***
Unemployment Experience	0.028***	0.018***	-0.013***	-0.025***	-0.0087***

Interestingly, in contrast with the wage regressions, immigrants arriving after 2007 have no additional disadvantage compared to other immigrants. The effect is insignificant and the sign even points to the opposite. This result is somewhat surprising and suggests that recent immigrants earn less than natives for doing the same jobs. Note that the extra penalty for

those who arrived after 2007 in the wage equations in section VII stays constant when autonomy is included in the regression.

How large is the effect of being an immigrant on the autonomy level compared to other characteristics? Figure 9 visualizes the average marginal effects reported above for medium and high education, as well as for immigrants born in advanced countries and other immigrants. Education is the most important factor, with high education being much more important than medium education. A highly educated person is 34 percentage points less likely to have low autonomy, 22 percentage points less likely to have low-medium autonomy, 15 percentage points more likely have medium autonomy, 31 percentage points more likely to have medium-high autonomy and 10 percentage points more likely to have high autonomy. The respective average marginal effects of being an immigrant not born in an advanced country are 30 percentage points, 20 percentage points, minus 13 percentage points, minus 27 percentage points and minus 9 percentage points. In contrast to substantial differences between immigrants from advanced and non-advanced countries regarding wages, the effect here is much smaller. Hence being an immigrant nearly offsets the advantages from high education.



One reason for a smaller difference for immigrants from different advanced and non-advanced countries could be that highly educated immigrants from advanced countries, while performing worse than natives regarding autonomy, at least do jobs that require their high education. Over two-thirds of highly skilled natives have a job matching their qualification and this fraction is even a bit higher for immigrants from advanced countries. In contrast, only 42 percent of the other immigrants have a good job match. When looking at high autonomy instead of job matches, the fraction decreases slightly for natives, but it remains above 60 percent. The decrease is stronger for immigrants born in advanced countries, but still half of them have a high autonomy. The same is true for only one-third of the other immigrants. The probabilities are only conditioned on high education and do not account for differences in other characteristics which could explain why fewer immigrants from non-advanced countries have high autonomy. Since it is widely believed that highly educated

immigrants are needed the most in the German labor market and since these are at the same time the ones penalized most, I explore their performance further.

I estimate three simple logit models: first, looking only at highly skilled immigrants, I employ a dichotomous dependent variable that is one when the immigrant has a job that requires high education and zero otherwise; second, I replace the dependent variable with a dummy that is equal to one in case the immigrant has high autonomy; and, third, I look at medium educated immigrants and use a dummy as dependent variable that is one if they have at least medium autonomy and zero otherwise. Table 4 reports the average marginal effects. I here report the change in probability due to working in a particular industry as well. The omitted category and therefore benchmark is working in Services.

While the years spent in Germany make it more likely for a medium educated immigrant to have a job with at least medium autonomy, there is no positive effect for highly educated immigrants. Surprisingly, the level of experience has even negative effects for highly skilled immigrants. For medium educated immigrants, on the other hand, there is again a positive effect, i.e. for them working for many years and gaining experience and obtaining human capital in the country translates into better jobs with higher autonomy and consequently higher wages. This prospect is absent for well-educated immigrants. As suspected, being born in an advanced country has a larger effect on having a job match than high autonomy. The opposite is true for a German degree that has a larger average marginal effect for having high autonomy. A German degree is particularly important for medium educated immigrants. In contrast to medium educated women, highly educated ones have a disadvantage over men, with a stronger effect for high autonomy than job matches.

Finally, there are some industries in which over-education and skill downgrading seem particularly common. For highly skilled immigrants these are Manufacturing and Trade, whether one looks at matches or high autonomy. For medium educated immigrants the sectors with the worst performing immigrants are in decreasing order Manufacturing, Transport, Mining (only at 10 percent significance level), and Construction. On the other hand, medium educated immigrants working in Banking and Insurances are over 30 percentage points more likely than those working in Services to have at least medium autonomy.

Table 4. Average Marginal Effects for Matches and High (Medium) Autonomy

VARIABLES	High Education		Medium Education
	(1) Match	(2) High Aut.	(3) Medium/High Aut.
Years in Germany	0.00380 (0.00546)	0.000217 (0.00501)	0.0115*** (0.00369)
Years in Germany Squared	-8.99e-06 (0.000115)	-4.95e-05 (0.000100)	-0.000158* (8.42e-05)
Arrived after 2007	0.0490 (0.0881)	0.133 (0.0920)	0.127* (0.0740)
Born in Advanced Country	0.135*** (0.0429)	0.227*** (0.0401)	0.104*** (0.0329)
Degree from Germany	0.119*** (0.0431)	0.0846** (0.0427)	0.145*** (0.0307)
Good German Writing Skills	0.0935*** (0.0318)	0.386*** (0.0575)	0.0528** (0.0243)
Experience	-0.0152** (0.00610)	-0.0193*** (0.00641)	0.00666* (0.00343)
Experience Squared	0.000118 (0.000147)	8.47e-05 (0.000128)	-0.000181** (8.04e-05)
Female	-0.239*** (0.0373)	-0.136*** (0.0407)	-0.0359 (0.0307)
Age	0.00705** (0.00316)	0.0125*** (0.00332)	-0.00467** (0.00222)
Unemployment Experience	-0.0547*** (0.0200)	-0.0402*** (0.0155)	-0.0407*** (0.00851)
Works in Agriculture	0.0882 (0.119)	-0.0464 (0.142)	-0.318*** (0.0703)
Works in Energy	0.00268 (0.128)	-0.142 (0.165)	-0.174 (0.129)
Works in Mining	- -	- -	-0.166* (0.0939)
Works in Manufacturing	-0.137*** (0.0453)	-0.242*** (0.0462)	-0.263*** (0.0335)
Works in Construction	-0.0300 (0.0695)	-0.0647 (0.0478)	-0.127*** (0.0360)
Works in Trade	-0.220*** (0.0743)	-0.390*** (0.0909)	-0.0619 (0.0400)
Works in Transport	-0.0500 (0.106)	-0.152 (0.0999)	-0.182*** (0.0448)
Works in Bank and Insurances	-0.210 (0.174)	-0.202 (0.155)	0.326** (0.151)
Observations	5,010	5,010	15,599
Controls	YES	YES	YES

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Controls: missing values for industry and language skills and year dummies, region, whether the person works full time and is married, as well as years spend in firm

IX. UNEMPLOYMENT AND PARTICIPATION

Wage performance, often the main focus in the literature, is clearly an important measure for the labor market performance of immigrants. However, unemployment and participation of immigrants are major policy concerns as well. Working eases the adjustment in the destination country (Hansen, 2012), reduces the use of fiscal transfers and increases the contribution to the economy and the fiscal budget (Hinte and Zimmermann, 2014; Dustmann and Frattini, 2014). Moreover, it also affects how immigrants are perceived by natives (Hainmueller and Hopkins, 2014).

In this section, I therefore look deeper into whether labor market participation among immigrants is as high as among natives (given other characteristics), whether being an immigrant translates into a higher probability of being unemployed, and what characteristics are important. To do so, I estimate two logit models with either unemployment or participation as the dichotomous dependent variable. I use the full sample and control for the region, age, and year fixed effects. As before, standard errors are clustered at the individual level.

Table 5 reports the average marginal effects for unemployment in columns (1) and (2). With every year of experience, the probability of being unemployed is reduced by 0.1 percentage points. Medium education reduces the probability by 1.3 percentage points and high education by 6.2 percentage points. Being a woman reduces the likelihood by 1.1 percentage points, which could result from the fact that women who are not working tend to drop out of the labor force if they do not find employment. Given these characteristics and the controls, an immigrant after arrival has a much higher probability (6.8 additional percentage points) to be unemployed than a native. To put this number into perspective, the average unemployment rate of natives over the whole sample was lower than 6.8 percent. Figure 11 plots the immigrants' average marginal effect for being unemployed. While with acquisition of experience in the country the effect decreases, it remains permanently positive and above 3 percentage points. Therefore, in addition to permanently lower wages, immigrants also face a permanently higher risk of unemployment.

An initially higher unemployment rate of immigrants is not surprising. For example, if immigrants have lower skills than natives when they enter the job market but then learn the skills for better paying jobs over time, they are more likely to change the job more often, which would in any period of the time result in a higher frictional unemployment rate (Chiswick et al., 1997). A permanent effect, on the other hand, is very worrisome and points to persistent labor market frictions for immigrants. In the U.S. the unemployment difference is not permanent and vanishes already after three years (Chiswick et al., 1997).

Column (2) considers different characteristics of immigrants in the same way as in the previous wage equations. An immigrant from an advanced country with a German degree and who writes German well has the smallest penalty (1.5 percentage points). Not being born in an advanced country increases the penalty to 3.5 percentage points, not writing German to 5.7 percentage points, and not having a German degree to 6.9 percentage points. Interestingly, the effects of education are different for natives and immigrants. The latter benefit again substantially less from their education. I add an interaction term of being an

immigrant and the economy-wide unemployment rate in order to see whether immigrants are more sensitive to changes in the rate. It could be the case, for example, that immigrants are over-represented in sectors particularly vulnerable during economic downturns (Kogan, 2004). However, I do not find any significant effects.

Table 5. Average Marginal Effects for Unemployment and Participation

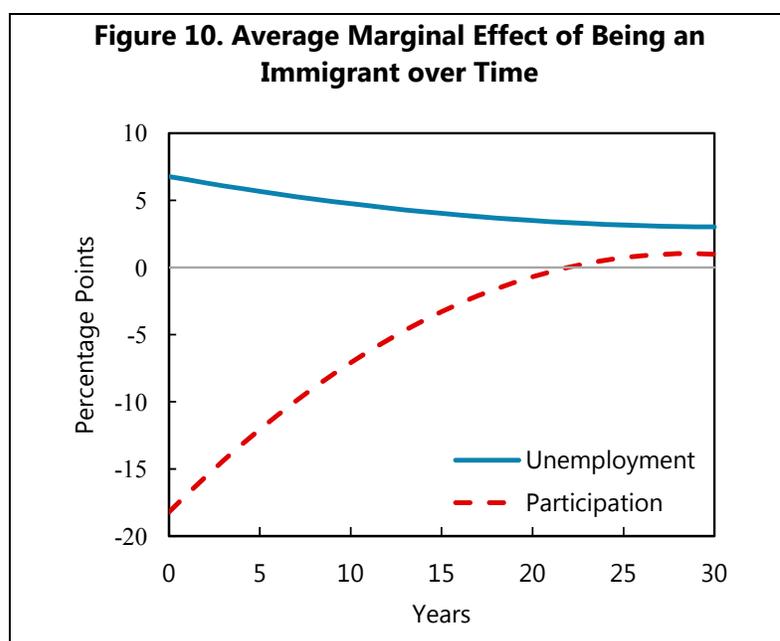
	Unemployment Rate		Participation Rate	
	(1)	(2)	(3)	(4)
Experience	-0.0011*** (0.00020)	-0.0013*** (0.00020)	0.014*** (0.00035)	0.014*** (0.00035)
Experience Squared	7.7e-06 (5.0e-06)	0.000014*** (5.0e-06)	-0.00026*** (8.3e-06)	-0.00026*** (8.3e-06)
Immigrant	0.068*** (0.0052)	0.069*** (0.0085)	-0.18*** (0.0094)	-0.15*** (0.014)
Born in Advanced Country		-0.020*** (0.0036)		0.038*** (0.0066)
Years in Germany	-0.0024*** (0.00047)	-0.00097** (0.00046)	0.014*** (0.00092)	0.013*** (0.00094)
YiG Squared	0.000039*** (9.7e-06)	0.000020** (9.7e-06)	-0.00024*** (0.000020)	-0.00024*** (0.000021)
Medium Education	-0.013*** (0.0020)	-0.018*** (0.0024)	0.037*** (0.0034)	0.034*** (0.0040)
Immigrant with Medium Education		0.0095** (0.0042)		0.0081 (0.0077)
High Education	-0.062*** (0.0029)	-0.073*** (0.0033)	0.097*** (0.0042)	0.092*** (0.0047)
Immigrant with High Education		0.049*** (0.0066)		0.020* (0.012)
Female	-0.011*** (0.0018)	-0.011*** (0.0019)	-0.094*** (0.0032)	-0.094*** (0.0032)
Good German Writing Skills		-0.022*** (0.0046)		0.014 (0.0091)
German Degree		-0.012*** (0.0040)		-0.012 (0.0077)
Unemployment Rate for Immigrant		-0.00024 (0.00090)		-0.0034*** (0.0013)
Observations	351,010	351,010	351,010	351,010
Controls	YES	YES	YES	YES

Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
Controls: region, the age, as well as year dummies.

I repeat the same regressions now with participation as the dependent variable and report the results in columns (3) and (4). Initially, every year of experience increases the probability to participate in the labor market by 1.4 percentage points, but the effect is decreasing over time. Medium education has a positive effect of 3.7 percentage points and high education of

9.7 percentage points. Given these characteristics, women are participating less; their probability to participate is 9.4 percentage points lower than that of men. An immigrant who just arrived in Germany is 18 percentage points less likely to participate but catches up over time.²⁰ Figure 10 plots the assimilation path. After 15 years the difference is down to less than 5 percentage points, after 20 years it is below 1 percentage point and after 22 years it is zero. In contrast to wages and unemployment, participation hence fully converges. This is an important result because it shows that immigrants want to work. It is also not necessarily expected given the fact that Germany has a relatively high labor market participation by women in international comparison (though women tend to work part time).

Antecol (2000) shows that the participation of migrant women is correlated with their participation rate in their home countries. A full convergence means that even such cultural differences are compensated within one generation.²¹ Chiswick et al. (1997) find full assimilation in the U.S. as well and at a faster rate than in Germany (10 years).



Next, I compare different immigrants. In contrast to the probability of being unemployed, neither a degree from Germany nor German writing skills affect the decision to participate. Moreover, the effects of education are the same for natives and immigrants. Only the origin of the immigrants matters. The gap of immigrants born in advanced countries is 25 percent smaller than that of other immigrants. Somewhat surprisingly, the participation rate of immigrants—in contrast to their probability of being unemployed—is more sensitive to the overall unemployment rate in the economy, but the effect is rather small quantitatively.

²⁰ It is often argued that one reason for the lower participation rate after arrival is that immigrants are taking courses, for example language courses. While certainly true, I excluded all persons in education or training from the analysis so that this effect is minimized.

²¹ Also Antecol (2000), who studies the US, finds assimilation over time. However, she does not find full convergence within one generation.

X. ROBUSTNESS CHECKS

Regarding the robustness of the results presented above, one could wonder to what extent the use of the individual sample weights matters. Or one could be interested to what extent the uncertainty about the survey structure increases the uncertainty of the estimates. I therefore re-estimate the most elaborate specification of the wage equation, which necessarily breaks down the sample into the smallest subgroups, first, without the weights and, second, using the random group variance estimator (as described in Wolters, 2007). The latter estimator offers an alternative for the GSOEP, as participants are sorted in random groups during data collection. Table A9 in the Appendix reports the results. When the model is estimated without the weights, the wage gap for immigrants becomes somewhat smaller and as a *quid pro quo* the returns to education of immigrants go down. The effects of being born in an advanced country and having migrated after 2007 become smaller as well. All other coefficients remain either the same or change only minimally. While the results are not identical, they are not changing fundamentally. Given that the individual weights have recently been improved due to the new information available from the Census 2011, I prefer the specification with weights as the benchmark. The use of the random group variance estimator tells us whether the survey structure has implications for the uncertainty of our estimates. In general, standard errors are very similar, but not without exception. In particular, while the catching-up process is highly statistically significant using clustered standard errors, it is only significant at the 10 percent level using the random group variance estimator. However, when switching to a specification with fewer interaction terms, the linear term is again significant at the 2 percent level and the quadratic term at the 7 percent level.

I also re-estimate the wage equation using the Heckman correction method in order to correct for selection bias. More specifically, in the first stage regression I estimate the likelihood that the individual is in work and in the second stage I estimate the wage regression conditional on being in work. The results indicate that my results are not distorted by a selection bias. I hence do not report these results.²²

As an additional robustness check, I re-estimate the models presented in section VIII and IX with probit instead of logit models. The probit regressions have a somewhat lower likelihood, which is why the results from the logit models are reported. In any case the results are nearly identical and the specification does not matter for the results.²³

In summary, all the results reported above are very robust to different model specifications or estimation techniques. Furthermore, there is no sample selection bias for immigrants.

²² Even Adsera and Chiswick (2007), who focus much more on women than this paper, do not correct for the selection bias in their main specification.

²³ Results can be requested from the author.

XI. CONCLUSION

This paper provides an analysis of the labor market performance of immigrants in Germany. It shows that while immigrants make substantial contributions to the economy, they face more obstacles in the labor market than native workers, and these obstacles are overcome only gradually and never fully.

Some of the findings in this paper are relevant for the current policy debates in Germany. For instance, it is often argued that highly skilled immigrants are the most needed by German employers, and that Germany is not yet a prime destination for these immigrants compared to countries like the U.K., the U.S., or Canada. This paper has shown that highly skilled immigrants experience sizable skill downgrading and relatively large and persistent wage gaps in Germany. To attract highly-skilled immigrants, therefore, it is essential to understand better why such downgrading takes place and see if policies can reduce obstacles to skill transfer.

Another important topic is how the current large wave of refugees will fare in the labor market. The findings in this paper indicate that they may face bigger obstacles than the average immigrant from the past. While we still do not know a lot about the current wave of refugees, preliminary evidence points to lower education and qualification levels than for other immigrants (IAB, 2015). In addition, they come from non-advanced countries and they likely have no German degrees and cannot write German well. This analysis has shown that these immigrants – even conditional on characteristics like education and experience – are less likely to participate in the labor market and are more likely to be unemployed than other immigrants. Moreover, when they find work, they initially earn 30 percent less than otherwise similar natives. While these gaps decrease over time, the process is slow and immigrants remain more likely to be unemployed throughout. The introduction of the minimum wage last year may lower the wage gap of new immigrants, but at the same time may further increase their likelihood of being unemployed (Battisti and Felbermayr, 2015). While the recent influx of refugees helps to address a severe humanitarian crisis and constitutes an opportunity for boosting working age population in Germany, successful labor market integration of the newcomers must not be taken for granted. It will likely need some time, particular efforts, and decisive policy action.

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APPENDIX

Table A1. Summary Statistics of Full Sample

1984-2013	Min	Mean (Median)	Max
<i>Natives (286,377)</i>			
Age, in years	17	42.6 (43)	70
Female	0	0.49	1
Medium Education	0	0.57	1
High Education	0	0.24	1
Working	0	0.77	1
Unemployed	0	0.06	1
Not Part of the Labor Force	0	0.16	1
<i>Immigrants (55,320; 16 percent of sample)</i>			
Age, in years	17	43.1 (43)	70
Female	0	0.49	1
Medium Education	0	0.46	1
High Education	0	0.17	1
Working	0	0.69	1
Unemployed	0	0.10	1
Not part of the Labor Force	0	0.21	1
Years in Germany	0	20.2 (19)	62
German Oral Ability Good or Very Good*	0	0.71	1
German Writing Literacy Good or Very Good*	0	0.55	1
German Oral Ability and Writing Literacy Missing	0	0.83	1
German Degree	0	0.36	1
2013	Min	Mean (Median)	Max
<i>Natives (11,887)</i>			
Age, in years	17	44.9 (47)	70
Female	0	0.50	1
Medium Education	0	0.59	1
High Education	0	0.29	1
Working	0	0.84	1
Unemployed	0	0.056	1
Not Part of the Labor Force	0	0.11	1
<i>Immigrants (4,182; 26 percent of sample)</i>			
Age, in years	17	43.7 (43)	70
Female	0	0.51	1
Medium Education	0	0.49	1
High Education	0	0.23	1
Working	0	0.77	1
Unemployed	0	0.10	1
Not part of the Labor Force	0	0.13	1
Years in Germany	0	22.5 (21)	60
German Oral Ability Good or Very Good**	0	0.74	1
German Writing Literacy Good or Very Good**	0	0.62	1
German Oral Ability and Writing Literacy Missing	0	0.36	1
German Degree	0	0.36	1

* From those we have data. We have 8,663 observations.

** From those we have data. We have 3,388 observations.

Source: GSOEP, 1984-2013.

Note: For dichotomous variables 0 means "no" and 1 means "yes".

Table A2. Summary Statistics: Working Population 1984–2013

1984-2013	Min	Mean	Max
<i>Natives (200,388)</i>			
Age, in years	17	40.5	70
Female	0	0.43	1
Hourly Real Wage in EUR	2.81	14.9	85.0
Medium Education	0	0.57	1
High Education	0	0.28	1
Working Experience, in years*	0	15.6	55.1
Unemployment Experience, in years*	0	0.40	24
Trained for Job	0	0.57	1
Not Trained for Job	0	0.33	1
High Edu. Job Match	0	0.16	1
Autonomy (Job Type)	0	2.64	5
<i>Immigrants (35,472; 15 percent of sample)</i>			
Age, in years	17	41.5	70
Female	0	0.42	1
Hourly Real Wage in EUR	2.81	13.6	85.0
Medium Education	0	0.50	1
High Education	0	0.19	1
Working Experience, in years*	0	16.3	50.2
Unemployment Experience, in years*	0	0.74	27
Trained for Job	0	0.37	1
Not Trained for Job	0	0.40	1
High Edu. Job Match	0	0.083	1
Autonomy (Job Type)	0	1.92	5
Years in Germany	0	20.0	59
German Oral Ability Good or Very Good**	0	0.77	1
German Writing Literacy Good or Very Good**	0	0.61	1
German Oral Ability and Writing Literacy Missing	0	0.82	1
German Degree	0	0.38	1

* From those we have data. We have 198,085 observations for natives and 33,259 for immigrants.

** From those we have data. We have 5777 observations.

Source: GSOEP, 1984-2013.

Note: For dichotomous variables 0 means “no” and 1 means “yes”. The job autonomy is measured on a scale from 0 to 5.

Table A3. Summary Statistics: Working Population 2013

2013	Min	Mean	Max
<i>Natives (9,104)</i>			
Age, in years	17	43.6	70
Female	0	0.48	1
Hourly Real Wage, in EUR	3.87	15.0	48.3
Medium Education	0	0.57	1
High Education	0	0.33	1
Working Experience, in years*	0	16.7	52
Unemployment Experience, in years*	0	0.64	22
Trained for Job	0	0.59	1
Not Trained for Job	0	0.33	1
High Edu. Job Match	0	0.22	1
Autonomy (Job Type)	0	2.75	5
<i>Immigrants (2,942; 24 percent of working population)</i>			
Age, in years	17	42.4	69
Female	0	0.48	1
Hourly Real Wage, in EUR	3.93	12.7	48.3
Medium Education	0	0.51	1
High Education	0	0.26	1
Working Experience, in years*	0	17.1	45
Unemployment Experience, in years*	0	1.09	27
Trained for Job	0	0.41	1
Not Trained for Job	0	0.38	1
High Edu. Job Match	0	0.14	1
Autonomy (Job Type)	0	2.20	5
Years in Germany	0	22.0	57
German Oral Ability Good or Very Good**	0	0.78	1
German Writing Literacy Good or Very Good**	0	0.66	1
German Oral Ability and Writing Literacy Missing	0	0.36	1
German Degree	0	0.39	1

* From those we have data. We have 8,311 observations for natives and 769 for immigrants.

** From those we have data. We have 2,401 observations.

Source: GSOEP, 1984-2013.

Note: For dichotomous variables 0 means “no” and 1 means “yes”. The job autonomy is measured on a scale from 0 to 5.

Table A4. Educational Distribution

	Natives	Immigrants				
		all	before 1990	after 2007		
				All	Born in Advanced Country	All Others
Age, in years	44.9	43.7	50.8	33.9	34.7	33.7
Female, in percent	50.2	51.4	52.1	47.6	39.1	49.2
<i>Education: ISEC</i>						
1	1.4	6.0	6.5	5.8	3.7	6.2
2	10.5	21.6	21.4	14.2	3.5	16.2
3	51.6	36.5	39.2	32.6	31.4	32.8
4	7.2	12.8	12.1	14.6	5.8	16.3
5	7.3	3.0	5.4	0.0	0.0	0.0
6	22.1	20.1	15.4	32.7	55.7	28.5

Table A5. Downgrading: Distribution of Autonomy Levels in Percent

<i>Autonomy</i>	High Education				Medium Education				Low Education			
	Nat.	Immigrants			Nat.	Immigrants			Nat.	Immigrants		
		All	< 1990	> 2007		All	< 1990	> 2007		All	< 1990	> 2007
Low	1.12	7.57	3.29	11.86	11.86	29.99	24.65	37.39	30.64	59.23	55.49	77.03
Low-Medium	6.12	14.01	8.77	11.22	36.05	35.23	34.99	42.22	28.21	31.64	33.98	19.01
Medium	32.39	34.83	39.80	29.42	41.73	28.91	32.76	9.89	31.16	5.42	5.76	2.87
Medium-High	50.99	41.40	46.01	46.18	9.52	5.61	7.12	9.62	9.60	3.72	4.77	1.08
High	9.37	2.20	2.14	1.32	0.84	0.26	0.48	0.88	0.39	0.00	0.00	0.00

Table A6. Conditional Wages of Natives and Immigrants

Education (ISCED)	Natives			Immigrants		
	Percent	Wage in EUR	<i>s.e.</i>	Percent	Wage in EUR	<i>s.e.</i>
1	0.89	10.65	2.50	4.09	9.85	0.40
2	6.89	12.13	0.30	18.34	10.37	0.33
3	49.18	13.02	0.15	36.42	12.03	0.35
4	8.35	14.67	0.31	14.66	13.17	0.69
5+6	34.70	20.16	0.13	26.49	16.79	0.57
<i>Occupational Autonomy</i>						
1	9.67	9.76	0.19	30.96	10.06	0.23
2	24.95	11.33	0.08	28.40	11.25	0.32
3	37.82	15.25	0.15	25.13	14.14	0.55
4	23.83	21.42	0.31	14.77	20.27	0.80
5	3.74	24.53	0.64	0.74	27.92	2.04

Table A7. Cross-Correlations

	Hourly Real Wage	Immigrant	Age	Experience	Education	Female	Unempl. Exp.	Trained for Job	High Edu. Job Match	Autonomy (Job Type)
H. R. Wage	1									
Immigrant	-0.0731***	1								
Age	0.210***	-0.00963***	1							
Experience	0.221***	0.0267***	0.751***	1						
Education	0.354***	-0.220***	0.116***	0.0107***	1					
Female	-0.219***	-0.0415***	-0.0301***	-0.314***	-0.0286***	1				
Unempl. Exp.	-0.154***	0.0747***	0.0492***	-0.0565***	-0.0851***	0.0434***	1			
Trained for Job	0.201***	-0.190***	-0.0306***	-0.00502*	0.310***	-0.0192***	-0.146***	1		
H-E-Job Match	0.399***	-0.123***	0.124***	0.0217***	0.711***	-0.0596***	-0.0859***	0.272***	1	
Autonomy	0.457***	-0.322***	0.129***	0.102***	0.593***	-0.0862***	-0.185***	0.428***	0.536***	1
Agriculture	-0.0759***	-0.0253***	0.0157***	0.0351***	-0.0191***	-0.0393***	0.0153***	0.0117***	-0.0258***	-0.0504***
Energy	0.0382***	-0.0281***	0.00508*	0.0260***	0.0177***	-0.0475***	-0.0182***	0.0182***	0.0142***	0.0243***
Mining	0.0112***	0.0341***	-0.00243	0.0198***	-0.0196***	-0.0512***	-0.0138***	-0.00277	-0.0115***	-0.0218***
Manufacturing	0.00318	0.158***	-0.0271***	0.0708***	-0.133***	-0.134***	-0.0107***	-0.105***	-0.105***	-0.182***
Construction	0.0327***	0.0704***	-0.0296***	0.0751***	-0.0585***	-0.241***	0.0000309	0.0303***	-0.0418***	-0.0670***
Trade	-0.161***	-0.0171***	-0.0488***	-0.0869***	-0.130***	0.125***	0.0418***	-0.0692***	-0.154***	-0.0737***
Transport	-0.0189***	-0.0158***	0.00749***	0.0471***	-0.0667***	-0.0730***	0.000532	-0.0544***	-0.0568***	-0.0522***
Bank/Insurance	0.0978***	-0.0559***	-0.00802***	0.00397	0.0201***	0.0250***	-0.0410***	0.0332***	-0.0251***	0.0905***
Services	0.0684***	-0.133***	0.0738***	-0.0916***	0.273***	0.247***	-0.00285	0.121***	0.270***	0.252***

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ **Table A8 Cross-Correlations of Immigrants' Variables**

	Years in Germany	Born in EU	Good German Speaking Skills	Good German Writing Skills	German Degree	High Education	High Edu. Job Match	Autonomy (Job Type)	Experience
Years in German	1								
Born in EU	0.138***	1							
Speaks German Well	0.0444***	0.0200***	1						
Writes German Well	0.0444***	0.0202***	0.848***	1					
German Degree	0.259***	0.00933	0.0695***	0.0997***	1				
High Education	-0.000361	0.0348***	0.112***	0.126***	0.0697***	1			
High Edu. Job Match	0.0552***	0.0768***	0.101***	0.121***	0.0799***	0.633***	1		
Autonomy (Job Type)	0.158***	0.106***	0.121***	0.146***	0.246***	0.486***	0.509***	1	
Experience	0.380***	0.0944***	-0.0588***	-0.0773***	-0.258***	-0.0542***	-0.0298***	-0.0376***	1

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table A9. Mincer-type Wage Equations: Robustness

	Baseline	No Weights	Random Group Variance Est.
	(6)	(7)	(8)
Experience	0.019*** (0.00081)	0.019*** (0.00062)	0.019*** (0.00081)
Experience Squared	-0.00041*** (0.000017)	-0.00041*** (0.000014)	-0.00041*** (0.00002)
Medium Education	0.045*** (0.0079)	0.052*** (0.0063)	0.045*** (0.0093)
Immigrant with ME	-0.022 (0.014)	-0.049*** (0.010)	-0.022 (0.012)
High Education	0.10*** (0.011)	0.10*** (0.0086)	0.10*** (0.014)
Immigrant with HE	-0.085*** (0.024)	-0.11*** (0.019)	-0.085*** (0.023)
HE Job Match	0.22*** (0.010)	0.23*** (0.0080)	0.22*** (0.015)
Immigrant with HE JM	0.060* (0.033)	0.061** (0.026)	0.060** (0.023)
Female	-0.11*** (0.0061)	-0.12*** (0.0046)	-0.11*** (0.0052)
Unemployment Exp.	-0.024*** (0.0019)	-0.025*** (0.0015)	-0.024*** (0.0020)
Trained for Job	0.021*** (0.0048)	0.022*** (0.0039)	0.021*** (0.0066)
Autonomy (Job Type)	0.11*** (0.0030)	0.11*** (0.0024)	0.11*** (0.0050)
Immigrant	-0.12*** (0.030)	-0.076*** (0.019)	-0.12*** (0.031)
Years in Germany	0.0068*** (0.0024)	0.0070*** (0.0015)	0.0068* (0.0034)
YiG Squared	-0.00014*** (0.000053)	-0.00013*** (0.000034)	-0.00014* (0.000070)
Good German Writing	0.051*** (0.018)	0.042*** (0.012)	0.051** (0.019)
German Degree	0.0060 (0.013)	-0.00057 (0.0094)	0.0060 (0.013)
Born in Adv. Country	0.052*** (0.015)	0.020** (0.0090)	0.052*** (0.0071)
Migrated after 2007	-0.17*** (0.057)	-0.080*** (0.030)	-0.17** (0.050)
Controls	YES	YES	YES
Observations	224,272	224,272	224,272
R-squared	0.407	0.434	0.407

Robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1; Controls: region, married, working full time, the age, the number of years in the firm, as well as year and industry dummies.