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ABSTRACT

Earnings Assimilation of Post-reunification East German Migrants in West Germany*

We investigate the wage assimilation of East Germans who migrated to West Germany after reunification (1990-1999). We compare their wage assimilation to that of ethnic German immigrants from Eastern Bloc countries and international immigrants to West Germany who arrived at the same time. The analysis uses administrative as well as survey data. The results suggest that East Germans faced significant initial earnings disadvantages in West Germany, even conditional on age and education. However, these disadvantages were smaller than those of international immigrants, supporting the beneficial role of cultural similarity. The earnings gap relative to West German natives narrowed over time for all immigrants. These findings are robust to controlling for potentially endogenous return migration and labor force participation. Controls for fixed effects reveal that positive assimilation for East German and international immigrants was concentrated among highly educated immigrants.

JEL Classification: F15, J31, J61

Keywords: migration, earnings assimilation, internal migration, labor market integration, cultural similarity, Germany, reunification

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1. Introduction

In many industrialized countries, demographic aging causes worker shortages in the labor market and funding problems in pay-as-you-go social insurance programs. Immigration of a skilled workforce may help to address these problems. However, the contribution of immigrant workers to host country economies hinges on their labor market integration. A broad literature studies the integration of immigrants in destination country labor markets.[1] Mostly with reference to the U.S. labor market, recent debates focused on the characteristics of immigrant cohorts,[2] patterns of intergenerational integration,[3] and the relevance of data types for the analyses.[4] At the same time, we know little about the heterogeneity of different groups' initial immigrant-native earnings gaps, immigrants' earnings assimilation over time, and possible mechanisms determining these patterns. Therefore, it is important to understand past immigrants' labor market success to realistically assess the contribution of future immigrants to destination country economies.

This paper studies an exceptional example of cross-border migration: we investigate the labor market integration of East Germans who migrated to West Germany after the fall of the Berlin Wall (1990-1999). We measure earnings gaps relative to West German natives, study the speed of earnings assimilation, and compare East Germans to other immigrant groups in West Germany: international immigrants and ethnic Germans, i.e., individuals with German origins who migrated from former Eastern Bloc countries and were naturalized upon entry.

Individuals who grew up in the former German Democratic Republic, i.e., East Germany, share language, history, and some institutions (e.g., elements of the education

[1] Chiswick (1978) and Borjas (1985, 1995) are early seminal contributions. Chiswick & Miller (2015a) offer topical surveys of the literature.

[2] See, e.g., Abramitzky (2020), Peri & Rutledge (2020), or Villarreal & Tamborini (2018).

[3] See, e.g., Ward (2022), Orrenius & Zavodny (2018), and for a survey Sweetman & van Ours (2015).

[4] See, e.g., Rho & Sanders (2021), Kaushal et al. (2016), Picot & Piraino (2013), or Lubotsky (2007).

system) with their West German peers. Therefore, even though they grew up in a separate country, their integration into the West German labor market should be less burdensome than that of immigrants who do not speak the language and are unfamiliar with institutions (see, e.g., Isphording and Otten 2014). It is informative to compare integration processes across immigrant groups. If all immigrant groups face the same labor market, then integration differences might relate to immigrant characteristics. Differences in assimilation patterns then reflect the importance of such characteristics including language and cultural background. Traditionally, the concept of cultural similarity in context of immigration has been connected to measures of linguistic distance, joint colonial legacies, and even geographic distance (e.g., Belot and Hatton 2012). However, this neglects several dimensions that determine whether immigrants and natives share a sense of a common identity and 'cultural capital' (Bourdieu 1979). Bertrand and Kamenica (2023) point to a broad set of indicators of cultural distance which in our setting may differentiate East Germans from other immigrant groups to West Germany. The authors discuss media consumption, consumer behavior, time use patterns, social attitudes, and the naming of newborns. We discuss some of the most interesting differences in these dimensions below. Relative to ethnic German and international immigrants from all other countries East and West Germans are more culturally similar after sharing a joint history up until 1945. A particularly important element is that formal qualifications obtained in East Germany can be transferred and interpreted more easily in the West German labor market than certificates from other leading countries of origin such as Turkey, former Yugoslavia, or Poland.[5] Therefore, we expect substantial advantages for East German migrants upon entering the West German labor market.

This paper offers five main findings: first, even conditional on age and education, East Germans faced significant initial earnings disadvantages in West Germany. These

[5] See Riphahn and Trübswetter (2013) on secondary education and Fedorets and Spitz-Oener (2011) on vocational training in East and West Germany.

disadvantages were smaller than those of international immigrants. Second, the earnings gap relative to West German natives narrowed over time for East Germans. The speed of adjustment does not differ from that of other immigrants. Both results suggest that cultural similarity may matter but certainly is not the only determinant of immigrant-native wage gaps. Third, assimilation rates differ over the duration of stay which is contrary to empirical specifications used in the literature. In addition, they vary between early and late migration cohorts, by gender, and for employment in the private vs. the public sector and by cultural distance to West Germany. Fourth, these findings are robust to controlling for potentially endogenous return migration and labor force participation. Finally, estimations with individual fixed effects reveal that positive assimilation for East German and international immigrants was concentrated among highly educated immigrants.

The literature on international immigrants' labor market assimilation in traditional immigrant-receiving nations suggests that upon arrival immigrants typically earn less than their native-born peers.[6] With increasing host country-specific experience immigrants' earnings rise. The gap narrows and eventually closes, or is even reversed. The analysis of these patterns can be demanding due to potential estimation biases, e.g., connected to cohort-specificity (Borjas 1985) or self-selection (Cohen & Haberfeld 2007, Dustmann & Görlach 2015). Selective out-migration can generate a downward bias in estimated assimilation if, e.g., high-earning immigrants return to their country of origin. Another source of bias relates to labor force participation: delayed employment entry of lower-earning immigrants can wrongly suggest a lack of earnings assimilation of immigrants (Rho & Sanders 2021).

In comparison to the literature on international migration, the number of contributions on domestic or internal migration is more limited (Ward 2022 and Jia et al. 2023). They stress

[6] Prominent studies include Chiswick (1978), Card et al. (2000), Card (2005), or Abramitzky et al. (2014) for the case of the United States, McDonald & Worswick (1998) or Warman & Worswick (2015) for Canada, and McDonald & Worswick (1999) or Antecol et al. (2006) for Australia.

the relevance of migration costs, the heterogeneity of migration motives, and policies.[7] While German reunification offers a specific, different setting it might provide relevant insights for these types of situations.

Studies on international immigrant assimilation in Germany mostly show a persistent earnings disadvantage and flatter age-earnings profiles for immigrants.[8] Okoampah (2016) finds no significant earnings assimilation for international immigrants in West Germany. Brunow & Jost (2021a, 2021b) confirm that immigrants' earnings display flatter experience profiles than natives' (Zibrowius 2012). The authors argue that immigrant earnings assimilation hinges on the recognition of existing educational and vocational qualifications, the completion of a German formal degree, language skills, and knowledge of labor market institutions. These factors differentiate East German immigrants to West Germany from their international peers.

A substantial literature studies the internal migration decisions of East Germans after reunification[9], the East-West wage gap[10] and the East German labor market.[11] Prior research on East-West German migrants' labor market assimilation is limited. Gernandt & Pfeiffer (2009) and Smolny & Kirbach (2011) cover earnings differences between East and West Germans in West Germany but do not determine individual assimilation paths (see also Rainer & Siedler (2009), Burchardi & Hassan (2013)). Emmler & Fitzenberger (2020) investigate the causal returns to East-West migration and find that even though East-West migrants are negatively selected migration has sizeable positive earnings and employment effects compared to staying in East Germany. While these authors compare the earnings of East-West migrants to

[7] Recently some papers discussed the integration of internally displaced persons (e.g., Rozo and Winkler 2021).

[8] See, e.g., Dustmann (1993), Schmidt (1997), Fertig & Schmidt (2001), Worbs (2003), and Zibrowius (2012).

[9] See, e.g., Burda et al. (1998), Hunt (2006), Brücker & Trübswetter (2007), Fuchs-Schündeln & Schündeln (2009).

[10] See, e.g., Burda et al. (1998) , Franz & Steiner (2000), Görzig et al. (2005), Kluge & Weber (2018), or Heise & Porzio (2019).

[11] See Brüll & Gathmann (2020) and Hunt (2001) and Alm et al. (2014) for earlier contributions.

developments in the source region in East Germany, we compare their labor market outcomes to West Germans and international immigrants in the destination region, i.e., in West Germany.

A fascinating literature studies similarities and differences between East and West Germans after reunification. Alesina and Fuchs-Schündeln (2007) as well as Becker et al. (2020) discuss political preferences; the former argue that East Germans' preferences with respect to the role of the state were shaped by Communism while the latter point to pre-existing East-West differences and selective outmigration from East Germany which might bias the comparison. Another well-known difference between East and West Germans relates to the social norms of female labor force participation. Campa and Serafinelli (2019) show that East German women attribute more importance to work than West German women. Boelmann et al. (2020) find similar patterns among recent mothers where East Germans return to labor market faster and for longer hours than West German mothers. So, while language and cultural background are similar, certain differences remain between the two groups.

According to human capital theory (Duleep & Regets, 1999), the initial disadvantage of immigrants in the host country labor market can be explained by an imperfect transferability of human capital. The subsequent rise of earnings in post-migration years is often connected to migrants' low opportunity cost of investment into host country-specific human capital. The transferability of skills gained in home countries and the ability to acquire new skills determine the pace of individual economic integration. The speed of this process mainly depends on the geographic, cultural, and linguistic distances between the sending and receiving countries (Sweetman & van Ours, 2015). In this context, East German migrants are unique due to the low or even missing cultural, geographic, and linguistic barriers between the sending and receiving regions in Germany. Therefore, their investment in host country-specific human capital and the reduction of labor market disadvantages relative to native workers should require less effort compared to traditional immigrants. Therefore, we expect faster integration for East Germans than international immigrants in West Germany. We test this hypothesis based on earnings

levels and adjustments for different immigrant groups. We build on the literature on heterogeneities by immigrant cohorts and inspect assimilation patterns by age at migration and length of stay. We describe heterogeneities along dimensions such as gender, and public vs. private sector employment and investigate whether differences in skill level, tertiary sector employment, and cultural values are associated with group-specific patterns. Finally, we test whether out-migration, selective labor market participation, or sample composition effects affect our results.

We offer three contributions to the literature. First, our case study of East German migrants to West Germany in comparison to international immigrants offers a unique setting to analyze integration patterns over time. Given the East-West German cultural similarity East German immigrants have a different starting point for their integration in the West German labor market. We can test to what extent it matters.[12] Second, we add to the literature that discusses the relevance of data types (e.g., cross-sectional versus longitudinal data). We apply cross-sectional and panel data estimators and compare findings from survey and administrative data. Rho & Sanders (2021) show that the study of earnings assimilation based on cross-sectional analyses can yield biased results due to selective outmigration and labor market participation; similarly, Lubotsky (2007) found substantially slower earnings assimilation when using longitudinal administrative than census data. Third, most prior studies of immigration to West Germany find no evidence of earnings assimilation, stress the flat immigrant age-earnings profiles, and point to persistent earnings disadvantages of immigrants. Looking at East German immigrants in the West German labor market indicates whether these findings are connected to characteristics of the West German labor market as opposed to those of immigrant groups.

[12] For a survey on the relevance of language skills for immigrant labor market integration see Chiswick & Miller (2015b) and the studies cited there. For the German case see, e.g., Dustmann (1994) and Dustmann & van Soest (2001, 2002).

This paper is structured as follows. In section 2 we review the historical background of immigration to West Germany. Section 3 presents our empirical approach. We describe our data, samples, and variables in section 4. Section 5 shows our findings and heterogeneity analyses, and section 6 presents the results of robustness tests. Finally, section 7 concludes.

2. Background

We investigate the labor market assimilation of immigrants who came to West Germany after the fall of the Iron Curtain in the 1990s. In this section, we briefly characterize the historical situation for the three groups of immigrants that we study: those from East Germany, ethnic Germans arriving from Eastern Europe and the former Soviet Union (*Aussiedler*), and all other international immigrants.[13] While East Germans shared the same country and traditions with native West Germans until 1945 and international immigrants generally have no ethnic ties to West Germany, ethnic Germans as a middle group feature some cultural similarities and at times some language skills. **Table 1** shows the annual size of different immigrant groups which we now address in turn.

In May 1989, Hungary opened its borders for emigration to Western Europe and on November 9, 1989, the Berlin Wall fell. Following these events, East-West migration increased substantially after it had been restricted for decades: while in 1988 there were about 32,832 East-West migrants (*Übersiedler*) the number rose to 388,396 one year later (Bauer & Zimmermann 1997). The first large wave of East-West migration occurred around reunification: between 1989 and 1991 more than 800,000 East Germans moved to West Germany (Schwarze & Wagner 1992) with another 440,000 in the years 1992-1994. The initial surge slowed down in the mid-1990s only to subsequently rise again and reach a second peak

[13] For a comprehensive description of immigration to Germany after World War II see Bauer et al. (2005).

in 2001 (see **Figure 1**).[14] By the end of 2001, the cumulative net East-West migration amounted to 1.3 million individuals, constituting 7.5 % of the pre-reunification East German population (Brücker & Trübswetter, 2007). In West Germany, East German immigrants were newly exposed to a market economy. Thus, due to their East German human capital these migrants partly confronted labor market assimilation processes similar to those experienced by international migrants. East-West immigrants were simultaneously domestic and cross-border immigrants and had to adjust to labor market requirements at their destination.[15] In comparison to those who stayed in East Germany East-West migrants did not differ in terms of formal education but were more likely to be male, young, and with a recent unemployment spell. Migrants tended to be less risk averse, less likely to be married, and with fewer children than those who stayed in East Germany (Emmler & Fitzenberger 2020). Regional unemployment in East Germany appeared to be uncorrelated with the migration decision; instead, earnings differentials were more important, particularly among younger migrants (Fuchs-Schündeln & Schündeln 2009; Hunt 2006). Based on aggregate data there were no specific gender patterns in East-West migration. However, the migration of married and higher educated individuals increased in the second migration wave (after 1997/98) (Fuchs-Schündeln & Schündeln 2009).

Since World War II and until the construction of the Berlin Wall in 1961, West Germany had experienced immigration of ethnic Germans (*Aussiedler*) from other Eastern European countries. After the fall of the Iron Curtain the inflow increased similar to that from Eastern Germany: between 1989 and 1993 about 1.5 million '*Aussiedler*' moved to West Germany (Bauer & Zimmermann 1997). Given the principle of citizenship by descent (*ius sanguinis*)

[14] While the first wave was in part determined by plant closures and unemployment in East Germany, the migration wave at the end of the 1990s consisted of the movement of predominantly young, highly qualified, and largely female East Germans. According to Kröhnert et al. (2009), their emigration was induced by economic and labor market opportunities in West Germany. Heiland (2004) offers a thorough collection of data on East-West migration flows since 1989.

[15] For a description of East-West migrants over time see, e.g., Fuchs-Schündeln & Schündeln (2009) or Hunt (2006).

they were naturalized upon entering the country. The large inflow caused the West German government to impose entry limitations including an upper limit of about 220,000 persons per year which was reached each year until inflows gradually decreased after 1995. Overall, about 3.1 million ethnic Germans moved to West Germany between 1988 and 2010 (Hirsch et al. 2014). While in the earlier decades, *Aussiedler* mostly came from Poland and Romania and had close ties to the German language and culture, those arriving in the 1990s almost exclusively came from the former Soviet Union and hardly spoke German (Glitz 2012). Initially allocated to specific geographic regions, their final destination was typically determined by ethnic group and family networks (for details see Glitz 2012). Hirsch et al. (2014) point out that the vast emigration movement to Germany renders selective emigration unlikely. The situation in the source countries may be responsible for the negligible return migration of ethnic German immigrants after they arrived in West Germany.

In the 1990s, international immigration inflow to West Germany was no longer dominated by guest-workers.[16] Instead, asylum seekers and refugees became more important: they made up one percent of immigration in the early 1970s and over 30 percent in 1990 (Bauer et al. 2005, p. 217). They arrived from former Yugoslavia, Kurdish regions in Turkey, and other conflict areas. In addition, labor migrants from Eastern European countries immigrated based on different legal settings (*Werkvertragsarbeitnehmer),* as guest workers or seasonal workers. In our survey data, international immigrants with foreign citizenship arriving in West Germany in the 1990s predominantly originated in Turkey (19 percent), Poland (17 percent), Romania (10 percent), and successor states of former Yugoslavia (19 percent).

3. Empirical approach

[16] For studies on the labor market integration of guest-workers in West Germany see, e.g., Algan et al. (2010), Ingwersen & Thomsen (2021), and Brücker et al. (2021) and studies cited there.

Our empirical analysis of the economic integration process of immigrants in West Germany proceeds in four steps. First, we describe the unconditional and conditional earnings difference between natives and East German, ethnic German, and other international immigrants to offer a general starting point and background for the subsequent analysis. We estimate the following linear model separately for each immigrant group in comparison to West German natives to determine the average conditional immigrant-native wage difference:

$$Y_{i,t} = \alpha_0 + \alpha_1 X_{i,t} + \alpha_2 \text{Year } FE_t + \beta \text{ Imm}_i + \varepsilon_{1,i,t} \quad (1)$$

The dependent variable Y measures log real gross wages for individual i in period t. We condition on education, gender, and age as an indicator of potential labor market experience (X). Additionally, we control for a set of calendar year fixed effects to account for potential business cycle effects. ε is a random error term. The estimate of β - the coefficient of the immigrant indicator (Imm) - provides the average conditional wage difference between natives and immigrants.

The second step of our analysis focuses on two key concepts used in the international literature on immigrant integration (for a recent discussion see Albert et al. 2022): for each group of immigrants, we determine the initial wage gap as observed immediately upon migration. Also, we measure the average annual rate of wage assimilation. We specify the empirical model as follows and estimate it separately for each immigrant group in comparison to West German natives:

$$Y_{i,t} = \alpha_0 + \alpha_1 X_{i,t} + \alpha_2 \text{Year } FE_t + \beta_0 \text{ Imm}_i + \beta_1 (\text{Imm}_i * \text{YIWG}_{i,t}) + \varepsilon_{2,i,t} \quad (2)$$

The variable 'years in West Germany' (YIWG) measures the number of years an immigrant has spent in West Germany since migration. It is coded zero for natives and for immigrants in their first year upon arrival. β_0 measures the initial conditional wage difference between natives and immigrants in the same gender-age-education cell upon arrival. The coefficient β_1 shows to what extent an additional year in the host country changes the initial earnings gap. We also

investigate whether assimilation patterns are nonlinear with respect to the duration of stay by replacing YIWG with a set of indicator variables.

In the third step of our analysis, we study heterogeneities in the initial wage gap and wage assimilation of immigrants by adding interaction terms to the specification. In particular, we follow the international literature and test whether integration patterns differ by immigrant cohort and age at arrival, we compare the patterns for men and women, and for individuals working in the private and the public sector.

The results of steps one to three constitute our baseline findings and describe the economic integration patterns of immigrant groups in West Germany. These results may be affected by non-random return migration, endogenous selection into employment (see, e.g., Rho & Sanders 2021), or unobservables determining sample composition and the initial selection into migration (see Emmler & Fitzenberger 2020, Kaushal et al. 2016, Lubotsky 2007). Therefore, in step four of our analysis we consider controls for (i) endogenous return migration, (ii) labor market participation, and (iii) individual-level fixed effects. In doing so, we follow Rho & Sanders (2021) and Kaushal et al. (2016). To evaluate the impact of return migration, we repeat our cross-sectional estimations by only considering those observations who remained in West Germany for at least 5, 8, and 10 years. To also account for endogenous employment choices, we additionally consider only individuals who were in full-time employment for at least 5, 8, or 10 years. Finally, we consider controls for time-constant unobserved heterogeneities which may affect selection into migration, into staying in West Germany, and into full-time employment by accounting for individual-level fixed effects ($\alpha_{0,i}$) in the following model which we estimate separately comparing each immigrant group to native West Germans:

$$Y_{i,t} = \alpha_{0,i} + \alpha_1 X_{i,t} + \alpha_2 \text{ Year FE}_t + \beta_1 (\text{Imm}_i * \text{YIWG}_{i,t}) + \varepsilon_{3,i,t} \quad (3)$$

In model (3) we can no longer identify the coefficients of time-constant explanatory variables. Under the strict exogeneity assumption the fixed effects estimator yields consistent estimates of the assimilation effect measured by coefficient β_1.

4. Data

The literature on immigrant integration broadly discusses the relative benefits of using survey data, which is often rich in information but offers only small samples, versus the benefits of administrative data, which typically offers large samples and precise data but a smaller number of indicators (Lubotsky 2007, Rho & Sanders 2021). We estimate the models using both survey and administrative data. Thus, we exploit the advantages of both and simultaneously evaluate whether the results agree. Next, we characterize the data in turn.

4.1 Survey data from the SOEP

Our survey data are taken from the German Socio-Economic Panel (SOEP) v34 (SOEP 2017, Goebel et al. 2019) and cover the years 1991-2018. The SOEP is a nationally representative annual household panel survey. In 1990, observations from the German Democratic Republic (GDR) were added to the originally West German sample. The data on East Germans cover the period since the start of the transition from a centrally planned to a market economy.

We study the West German post-reunification labor market. We distinguish four population groups of full-time employed males and females, aged 21-65 years, who live in West Germany at the time of the interview, and for whom wage information is available. In addition to natives, we consider three groups of first-generation immigrants who are first observed in West Germany during the 1990s as adults and thus attained their initial training and human capital outside of West Germany. First, we consider East German migrants who reported in 1989 to live in the former German Democratic Republic, neither migrated to East Germany nor are the children of immigrants to East Germany, are German citizens, and moved to West

Germany in the 1990s. Second, we consider ethnic Germans who moved to West Germany from the former European Eastern Bloc countries and hold German citizenship.[17] Finally, we consider all other international migrants with non-German citizenship. Our reference group are native German citizens, who are born in Germany, neither first nor second-generation immigrants, sampled in West Germany, do not have an East German educational degree, did not live in East Germany in 1989, and lived in West Germany between 1991 and 1999 and afterwards. For these four groups, we retrieved data for as long as they lived in West Germany at most until 2018.[18] After omitting a few observations due to missing values on covariates, the analysis sample is an unbalanced panel consisting of 48,463 person-year observations.[19] 1,417 of these panel observations belong to 160 individuals from East Germany, 1,205 to 162 ethnic Germans, and 1,283 to 213 other international migrants. 44,738 person-year observations result from 4,602 native West Germans.

Our measure of labor market outcome Y, is the natural logarithm of real gross hourly wage of full-time employees in 2015 Euro.[20] We trim the top and bottom percent of annual wage observations from the pooled samples to reduce the potential effects of outliers on the estimation.

Our central explanatory variable is YIWG, the cumulative number of years spent living in West Germany since the first move. We estimate the coefficients β for the three immigrant groups based on equations (1)-(3). The information on individuals' residence combined with

[17] We use information on self-declared ethnic German immigrant status which was collected in 1996 and infer an individual's status based on their country of origin.

[18] For residents of East Berlin, we record a move to West Germany only if they move to West Germany excluding West Berlin. Residents of West Berlin are not part of the analysis. We do not consider commuters between these two regions because we cannot identify them over the entire survey period. Also, we do not consider observations that were added to the survey after 2000.

[19] We drop 1,156 observations or 2 percent of the raw sample due to missing values.

[20] Hourly wages are calculated based on imputed gross labor income in the month before the interview which includes overtime payments. The number of hours worked is the actual number of weekly working hours including overtime.

the longitudinal nature of the data allows us to calculate the duration of time spent in West Germany at every point in time; for immigrants from East Germany, we allow for repeat migration and for more than one spell in West Germany; in these instances, the count of YIWG may be interrupted. For ethnic Germans and other international migrants, we use the self-reported year of arrival to calculate YIWG because in these cases return migration and panel attrition are not distinguishable.

Table 2 presents descriptive statistics on the main variables for the four groups. In terms of mean hourly wages, East German migrants lag slightly behind West German natives, whereas ethnic Germans record the lowest wages among all four groups. On average, East German migrants have the highest share (35%) of females in this sample of full-time employed workers in West Germany. Ethnic Germans feature the highest average age of 44 years in our sample whereas international immigrants are the youngest with an average of 39 years. Overall, East German migrants have the highest share with formal tertiary education and international immigrants have the highest share of individuals without vocational training. Connected to their later arrival and possibly due to the lower cost of return migration East Germans in our sample spent on average fewer years in West Germany than the other immigrant groups. Most immigrants arrived early in the 1990s and more than 80 percent migrated at age 40 or younger.

4.2 Administrative data from the SIAB

Our second data source uses administrative data from the German unemployment insurance. The data from the 'Sample of Integrated Labour Market Biographies (SIAB)' offer a 2 percent random sample of all individuals registered with the unemployment insurance (Antoni et al., 2019).[21] The data cover about 80 percent of the German workforce and exclude civil servants

[21] Specifically, we use the weakly anonymous version of the SIAB 1975-2017 and accessed the data via a Scientific Use File at the Research Data Centre (FDZ) of the German Federal Employment Agency (BA) at the Institute for Employment Research (IAB) in Nuremberg and via remote data access at the FDZ. DOI: 10.5164/IAB.FDZD.1902.en.v1

and the self-employed; since 1992 the data offer information on individuals originating in East Germany. We take advantage of precise information on the day-to-day employment status and earnings to code a panel dataset at an annual frequency.

In our sample, we again consider individuals who are aged 21-65 and work in full-time employment in West Germany.[22] To capture immigrants to West Germany, we restrict the sample of immigrants to those who are observed for the first time in our data in West Germany after 1990. This excludes any person employed or unemployed in West Germany before 1991.

Here, we define only three subgroups because it is not possible to identify ethnic Germans in the administrative data. East vs. West German regional origin is determined based on the region of first observed place of work. East German migrants in West Germany are German citizens who initially appear with a place of work in East Germany but later are observed in full-time employment in West Germany at any time between 1992 and 1999. This generates two types of measurement problems: first, very early East-West migrants (prior to 1992) cannot be detected in the data. Second, among East-West migrants there might be individuals who originated in West Germany and return after an employment spell in East Germany. However, if their first observed employment was observed to be in West Germany, they are not considered to be East-West migrants. Therefore, as only those West Germans are wrongly assigned who had their very first employment spell in East Germany the resulting measurement error should be minor. We consider individuals to be international migrants if they took up employment for the first time in West Germany between 1992 and 1999 and have a non-German citizenship. The group of West Germans comprises German citizens who initially appear in West Germany and work there full-time at some point in the 1990s. We follow the three groups in West Germany through 2017 and permit interruptions in full-time

[22] We do not include part-time employees because we do not know their exact number of hours worked.

employment.[23] Our final working sample is an unbalanced yearly panel with 38,200 observations of 4,069 East Germans, 121,105 observations of 16,318 international migrants, and 5,739,853 observations of 480,593 West German natives.

Our measure of labor market outcome, Y, is the natural logarithm of real gross daily wage in 2015 Euro in an individual's main full-time employment, i.e., the job with the highest earnings. As the earnings information is censored, we use imputed earnings for those earning above the social insurance annual earnings ceiling.[24] We trim the top and bottom percent of the annual distribution of daily wages for the pooled sample.

Again, we are most interested in the coefficients of the indicators for the two immigrant groups and of the time-varying variable years spent in West Germany' (YIWG). As the administrative data do not generally offer information on individuals' place of residence, here the YIWG measure counts the cumulative number of years during which an individual was observed to be working in West Germany since the initial migration ignoring changes in the place of residence.[25] We allow for return and repeat migration for all immigrant groups and do not count years of absence from West Germany in YIWG.

Table 3 presents descriptive statistics on the main variables for the three groups. In terms of mean daily wages, East German migrants (108 Euros) lag behind West German natives (123 Euros) but international immigrants record the lowest daily wages (93 Euros). Similar to the SOEP data, about one-third of the East and West German observations are female. Again, international immigrants are on average at least two years younger than their East and West German counterparts. International immigrants have again spent more time in West Germany

[23] As the data do not distinguish origins in East vs. West Berlin, we omit observations who at some point in their biography work in Berlin; similarly, we omit small shares of observations without information on citizenship and education.

[24] The imputation of right-censored wages is a two-step procedure similar to Dustmann et al. (2009) and Card et al. (2013) and based on Gartner (2005). For a detailed description, see also Dauth and Eppelsheimer (2020).

[25] The SIAB data offer information on individuals' place of residence since 1996.

than East Germans. As before, East German migrants have the highest share of tertiary educational attainment even exceeding that of West Germans. In our data, the year of immigration is rather balanced across the 1990s for East German and international immigrants, with a high propensity to migrate at early ages. The share of public sector employment is similar for East and West Germans but lower for international immigrants. Expectedly, West German natives are more likely to work in high-skill occupations than the other two groups.[26]

In order to assess the similarity of the immigrant groups in terms of their initial choice of regions, industries, and occupations Appendix **Table A.1** offers additional information. The largest groups of migrants reside similar to West German natives in Bavaria, Baden-Württemberg, North Rhine-Westphalia, and Lower Saxony. It is not surprising that East Germans are more likely than international immigrants to reside in West German states at the East-West border (i.e., Schleswig-Holstein, Lower Saxony, Bavaria). The initial distributions across industries and occupations are rather similar for the East German and international immigrants. Larger differences appear with respect to the employment share in hotels and restaurants, which is considerably higher among international immigrants. While international immigrants more frequently work in simple and manual occupations, the share of East Germans in skilled occupations is higher.

4.3 Comparison of survey and administrative data samples

Even though we aimed at generating comparable survey and register-based datasets a few differences remain. First, the dependent variables are scaled differently. We use hourly wages with the SOEP data and daily wages in the administrative data because information on the number of hours worked is not available there. Second, the subsample of ethnic German

[26] Job complexity reflects the skill level required for a given occupation and is coded in four categories (see Schmucker et al. 2023 and Paulus and Matthes 2013). We aggregate categories 1 and 2 to indicate low-skill jobs and categories 3 and 4 to indicate high-skill jobs.

immigrants can only be studied based on SOEP data. Since these individuals are naturalized when entering Germany, they are indistinguishable from and mixed with natives in administrative data. Third, the SIAB data omits observations on individuals who are self-employed or civil servants because these groups are not registered with the unemployment insurance. This explains the much lower share of public sector employment in the SIAB compared to the SOEP data. Forth, we identify East German migrants in West Germany based on the sampling region in the SOEP and based on the region of employment in the SIAB. Finally, YIWG is measured based on years lived in West Germany in the SOEP and based on years worked in West Germany in the SIAB data.

Despite these differences, the descriptive statistics in **Tables 2** and **3** yield several similarities. **Figure 2** describes the ratio of East and West German full-time employed workers' average wages in the West German labor market over time for both samples. Initially, the ratio is higher in the SOEP than in the SIAB data but the shares converge. The ratio remains below parity in both samples for the full period of observation with a positive trajectory in the administrative data.[27]

4.4 Average differences over time

Before starting our main analyses, we describe the average earnings difference between immigrants and natives in West Germany based on equation (1) separately comparing each immigrant group to West German natives. The two entries in the first columns of **Figure 3** (see

[27] The distance between the two lines is likely related to systematic differences between the data sources: (i) the SOEP survey data include civil servants and the self-employed, who are missing in the administrative data. We found that omitting both groups for the SOEP data does not change the overall patterns. (ii) We use hourly wages in the SOEP and daily wages in the SIAB, both for full-time employed workers. Relative shifts in the number of hours worked for the two groups (which we find in the SOEP) affect the developments. (iii) SIAB data are censored and therefore imputed while SOEP data are not censored. (iv) Bonuses, vacation, or 'Christmas' payments are considered in the SIAB but not the SOEP data. If native West Germans benefit from those to a greater extent this may explain the level difference between the two samples.

Table A.2 in the appendix) show the coefficient estimates of the immigrant indicator for East Germans and international immigrants based on the administrative data. The three entries in the second column of **Figure 3** show the results based on survey data for East Germans, ethnic Germans, and international immigrants. Conditional on basic demographics (age, gender, education) and calendar year fixed effects we observe statistically and economically significant wage discounts for all groups relative to West German natives. Both, with administrative and survey data, East Germans in West Germany on average earn about 13 percent lower wages, the discount reaches 20-25 percent for international immigrants and even about 33 percent for ethnic Germans; at first glance, this suggests a benefit of cultural similarity.[28]

Our findings for East German migrants in West Germany are in line with those presented by Smolny & Kirbach (2011); they show that conditional on demographics East Germans in West Germany face a discount of about 10 percent.[29] Lubotsky (2007) shows that immigrant-native earnings differences in the U.S. vary substantially over time and across immigration cohorts. To evaluate such patterns in our data, **Figure A.1** shows estimates from administrative data of the immigrant (IMM) coefficient (β in equation 1) for calendar year interacted immigrant effects separately by job complexity. The results show declining wage disadvantages over time for both groups and job complexity levels. The discount is smaller and shrinks faster for immigrants from East Germany. This development is likely connected to the assimilation of immigrants over time, changes in the composition of the samples, and overall labor market

[28] We also estimated the models only controlling for year fixed effects. Generally, the results do not differ substantively. Instead of estimating the models separately for each immigrant group we also pooled all groups and estimated a joint model; here, the group-specific indicators yield almost exactly the same wage disadvantages.

[29] Gernandt & Pfeiffer (2009) also exploit SOEP survey data and compare hourly wages for matched samples of East Germans who migrated to West Germany and their West German peers in 2000-2005. These authors find no wage difference for the matched samples. However, for the unmatched data, they show that average East German migrants' wages converged from 53 percent to 75 percent of (unmatched) average West German wages between 1992 and 2005 which indicates even larger discounts than in our results.

developments. While the initial wage disadvantages relative to natives do not differ much by skill level, the wages of those in high-skilled jobs catch up substantially faster over time.

5. Results

5.1 Initial gap and immigrant assimilation

We study immigrants' initial wage gap in their first full-time position and the average annual wage assimilation rate relative to West German native wages over time. Based on equation (2), **Table 4** shows the coefficient estimates for the initial gap (β_0) and the annual assimilation rate (β_1) again using SIAB and SOEP samples. We use the model specification as in **Table A.2** which controls for basic demographics and calendar year fixed effects. In all five columns, the initial wage gap (coefficient of "Imm") is substantial, statistically significant, and at times even larger than the average wage difference observed in **Figure 3** (**Table A.2**). The initial wage gap of East German migrants in West Germany is slightly larger when estimated based on administrative than survey data (18 vs. 15 percent in columns 1 and 3). The initial wage gap of ethnic Germans in the survey data (column 4) exceeds that of the other groups. The survey-based estimates in columns 3-5 do not yield precise estimates of annual assimilation rates; for two groups the point estimates are even negative. In contrast, the average rates based on the SIAB data are estimated precisely. They suggest that average wages catch up 0.6 percent for each year spent in West Germany for both, East Germans and international immigrants.[30] These rates are rather small and in combination with the estimates of the initial gap indicate that East

[30] The estimates are robust to adding controls for the initial federal state of residence, the initial industry or occupation to the estimation model (not presented to save space). Instead of estimating the models separately for each immigrant group we also pooled all groups and estimated a joint model; here, the results are confirmed.

German and international immigrants need 30 and 50 years, respectively, to catch up with the wages of their West German peers.[31]

The findings of slow wage assimilation for international immigrants match findings in prior studies on immigrants in Germany: using SOEP 1984-2009 data, Zibrowius (2012) did not find a general decline in the immigrant-native wage gap over time. Similarly, Okoampah (2016) finds no assimilation for immigrants from non-OECD countries to Germany since 1948 using SOEP data for the period 1990-2012. Surprisingly, she concludes that the wages of immigrants from OECD countries hardly differ from those of natives. Also, Brunow & Just (2021b) conclude that immigrants have flatter experience profiles than natives.

The evidence on the assimilation of immigrants in the West German labor market differs substantially from patterns observed in the United States (US). Peri & Rutledge (2020) use census data to describe earnings trends for immigrants from Mexico and Central America who entered the US between 1965 and 2011. These immigrants started out with earnings disadvantages of 40-45 percent compared to natives but eliminated half of that over the first two decades in the US. Kaushal et al. (2016) use survey data and compare immigrant integration in the US and Canada. They find faster earnings, age, and hours assimilation of immigrants in the US and ascribe this to the lack of welfare institutions there. Similarly, Antecol et al. (2006) evaluate earnings assimilation of immigrants to the US by comparing them to their peers in Australia and Canada. The authors observe the largest initial disadvantage and the fastest assimilation for immigrants in the US. They argue that wage inequality and generosity of unemployment support explain the cross-national differences: with a compressed wage structure and generous income support as in Australia earnings assimilation occurs along the

[31] Several factors may explain why the coefficient estimates for international immigrants differ between the two data sources. In addition to heterogeneous sampling and variable definitions (see section 4.3) the SOEP data consider individuals who already immigrated in 1990 and 1991 whereas the SIAB immigrants entered in 1992 or later. In both data sources the largest national groups among international immigrants hold Turkish, former Yugoslavian, and Polish citizenship.

hours rather than the wage dimension. It is plausible that institutions like these explain the difference in immigrant assimilation between Germany and the US. In addition, it is noteworthy that the analysis of immigrant integration in the US focuses on monthly earnings whereas the German literature separates the wage and employment dimension. Peri & Rutledge (2020) emphasize that immigrant integration in Europe is affected by large employment gaps which we discuss in section 6 below.

So far, we investigated the average annual assimilation rate across all observations. As assimilation may not be time-constant, we re-estimated the models to allow for heterogeneity of assimilation rates across immigrants' duration of stay in West Germany. **Figure 4** depicts detailed estimates for the SIAB subsamples where the linear measure of YIWG is replaced with splines that control for the value of YIWG separately for each year (**Table A.3** presents estimation results for 5-year splines).[32] The results confirm that average assimilation rates decline over time for both groups which is in line with the international literature (Rho & Sanders 2021, Kaushal et al. 2016, or Antecol et al. 2006). Again, we observe at most small advantages for immigrants from East Germany.

5.2 Heterogeneities

Next, we study the heterogeneity of the initial gap and annual assimilation rates. First, we inspect differences within immigrant groups then we study patterns that relate to the differences between the groups. Due to its smaller sample, the SOEP data is unlikely to yield precise results in this regard; therefore, we use the administrative data, here.

Table 5 presents the estimation results that we obtain when we add main effects and interaction terms of the relevant indicators to the model as in **Table 4**. We first test whether our

[32] **Table A.4** presents the estimation results for second- and third-order polynomial representation of the assimilation effect for East German and international immigrants. This confirms that the initial gap is larger for international immigrants, that assimilation patterns are similar for the two groups, and initially assimilation proceeds at slightly faster rates for former East Germans.

results vary across calendar years of immigration. The question of whether the quality of immigrants changed over immigration cohorts has dominated the U.S. immigration literature over the last decades.[33] In our case, it is important that East German immigrants became more educated over time (Fuchs-Schündeln and Schündeln 2009). We consider a linear cohort indicator that enumerates the years 1992-1999 (see columns 1 and 2 of **Table 5** and summary statistics in **Table 3**). Similar to prior studies on German (e.g., Okoampah 2016, Hirsch et al. 2014) and US (e.g., Lubotsky 2007) immigration, we find significant differences by immigration cohort: East Germans arriving later face smaller initial wage gaps and faster wage assimilation. Possibly, higher education and more opportunities to learn about the West German labor market prior to migration supported their integration. In contrast, among international immigrants a late arrival, is associated with a slightly larger initial wage gap but again faster wage assimilation.[34]

Next, we evaluate whether the results vary by age at migration; as younger immigrants may be more flexible, cultural differences between the two immigrant groups might be more pervasive among older immigrants. We consider a linear indicator of age at migration and interact it with the years in West Germany variable (YIWG).[35] The results in columns 3 and 4

[33] For recent contributions see Peri & Rutledge (2020) and Villareal & Tamborini (2018) who both reject the hypothesis that recently arriving immigrants perform worse than earlier cohorts. This, however, differs from much of the previous literature which discussed declining immigrant quality over time (e.g., Antecol et al. 2006 and references cited there).

[34] The results for international immigrants agree with the findings of Albert et al. (2022). These authors point out that immigrants' initial wage gaps and wage assimilation are not only determined by skill accumulation but also by equilibrium effects of labor market competition. For the U.S., they find that these effects explain a large share of an increasing initial wage gap over the last 5 decades. Our finding of declining initial gaps for East Germans agrees more with a change in immigrant selection over time. Dustmann et al. (2023) show that low reservation wages of immigrants and a higher initial wage gap is affected by real exchange rates between the source and destination country. If relative East German prices increased over time in comparison to West German prices, we expect rising reservation wages and declining initial wage gaps. This matches our findings and offers an additional explanation for the observed developments.

[35] The linear measure of age at migration refers to the age when the individual first appears in the West German data. This should be a reliable measure for immigrants from East Germany

of **Table 5** yield almost identical age effects for both immigrant groups. They confirm that at the age of 21 when our first observations enter the West German labor market the initial wage gap would be negative for both groups. Wage assimilation rates continue to be positive. Those who immigrated at an advanced age on average realized significantly larger initial gaps. This aligns with the finding that the migration decision of older East Germans may have been determined more by negative unemployment experience than by positive wage expectations (Hunt 2006).

Columns 5-6 of **Table 5** show separate estimates by gender and employment in the private vs. public sector. For brevity, we focus on the East German subsample. The gender dimension is of particular interest because of the cultural differences in East and West German gender gaps (Boehlmann et al. 2020, Campa and Serafinelli 2019, or Beblo and Gorges 2018, Kleinjans 2024); as East German women were more attached to the labor force their disadvantage compared to West German females may be smaller than the disadvantage of East German men. Interestingly, East German female immigrants suffer indeed an about 17 percentage points lower initial wage deduction than East German immigrant men. At the same time, East German females' annual wages assimilate slower than those of their male counterparts.[36] Emmler & Fitzenberger (2020) confirm significant gender differences for East-West migrants. They find positive returns to migration for both genders but higher returns to migration for men.

because we condition the migration experience on being observed in the East German labor market in the administrative data first. However, for international immigrants, we may overestimate the age at migration by using the first year when an individual appears in the administrative data: international immigrants may have entered the country before appearing in our administrative data.

[36] Results for international immigrants (not presented) are slightly different: females have a smaller initial wage gap than men by about 10 percentage points (compared to 17 for East Germans) and realize a wage assimilation rate that is significantly larger by 0.38 percentage points compared to 0.54 for male international immigrants.

Next, we follow Peri & Rutledge (2020) and inspect the relevance of the industry of employment. We differentiate private and public sector employees (see column 6 of **Table 5**) and expect the immigrant disadvantage to be smaller in the public sector where earnings developments are more strictly regulated.[37] Overall, private sector employees in West Germany earn 2.3 percent higher wages than those in the public sector. Among East German immigrants who start employment in the public sector the initial wage gap is substantially and significantly lower by about 20 percentage points than that of East Germans who start employment in the private sector. In fact, an initial wage discount basically does not exist for East German immigrants employed in the public sector. The assimilation rate in public-sector jobs is slightly and insignificantly smaller than that of private-sector employees.[38]

Next, we consider a set of heterogeneity analyses that contribute to the explanation of different assimilation patterns between East German and international immigrants. **Table 6** presents the estimation results with respect to three dimensions of heterogeneity. In columns 1 and 2 we compare heterogeneities by occupational skill level. If individuals with high human capital integrate more easily, we expect smaller discounts for high-skill migrants. Interestingly, this holds true for international immigrants but not for workers in high-skill positions from East Germany: high-skill occupations reduce the initial gap for international immigrants, only. However, East Germans in high-skilled occupations enjoy very rapid wage assimilation rates (see **Figure A.1**). These group differences might result from different migration patterns. High-skill international immigrants might only migrate if they have a high-skill job. If, in contrast, East Germans moved to the West to find a job they may have had to overcome initial hurdles.

[37] We approximate public vs. private sector employment in the SIAB data based on industry of employment which may not be free from measurement errors.

[38] The significant initial wage benefit of public sector employment of about 20 percentage points exists in the international immigrant sample, as well (not presented to save space). Among international immigrants' wage assimilation is slightly (and insignificantly) faster among public sector employees.

Only, after they established themselves in the new environment, they could rapidly increase their earnings.

In columns 3 and 4 of **Table 6** we compare heterogeneities by sector of employment. If workers' language skills are more relevant in the tertiary than in the primary and secondary sectors, the advantage of East German workers in the West German labor market compared to international immigrants should be relatively larger in the tertiary sector.[39] We indeed find a substantial difference in the initial gap for East German and international immigrants working in the tertiary sector. While the initial gap is much smaller for East Germans if they work in the tertiary sector, it is higher for international immigrants relative to natives. These patterns might reflect the relevance of language differences.

Finally, column 5 of **Table 6** illustrates the role of cultural distance for international immigrants.[40] We investigate whether cultural distance modifies immigrants' labor market integration. The cultural distance indicator is available only for 6,240 out of the 16,318 international immigrants in our main sample and is coded to reflect societal values rather than language similarity. We find that those with a larger cultural distance start with a significantly larger initial earnings gaps in West Germany. This agrees with the heterogeneity patterns found for East Germans who are more culturally similar to West Germans than international immigrants.

6. Robustness Analysis

6.1 Alternative native sample

[39] We coded workers to be in the primary and secondary sectors if they work in agriculture, forestry, mining, fishing, manufacturing, energy, water supply, or construction industries. Everybody else is considered to work in the tertiary sector.

[40] The measure is taken from Kaasa et al. (2016). It reflects cultural distance based on a set of societal values (power distance, uncertainty avoidance, individualism-collectivism, and masculinity-femininity).

In the analyses presented so far, we followed the literature and compared the wages of immigrants to those of the native population, conditional on age, gender, and education.[41] This approach glosses over a potentially important difference between immigrants and West German natives: natives on average already accumulated firm-specific human capital which newcomers cannot have. To determine wage differences and assimilation rates that account for differences in tenure, **Table 7** replicates the results of **Table 4** when we maintain only those West Germans who - just like the immigrants - start a new job in the observation period. This reduces sample sizes from 5.8 to 3.6 million for the SIAB and from about 46 to 23 thousand for the SOEP data. Now, the initial wage gap drops by about 5 percentage points in all five columns and the rate of annual wage assimilation estimated with the administrative data drops from .6 to .4 percent per year. Patterns of statistical significance and relative effect sizes between immigrant groups are unaffected by changing the native sample. The results show that the lack of firm-specific human capital explains some of the initial wage gap. Interestingly, its relevance is larger in relative terms for East German than for international immigrants.[42]

6.2 Return migration and continuous employment

The international literature shows that estimates of wage and earnings assimilation can be sensitive to selection into return migration; Abramitzky et al. (2014) and Lubotsky (2007) find that estimates of immigrant assimilation in the US declined after accounting for selective emigration of immigrants with below-average earnings.[43] In **Table 8** we describe the effect of

[41] In additional estimations that are not presented to save space we determined the robustness of our main results to the choice of an estimator. Neither with median regression, nor with robust regression (rreg, Stata), nor with dfbeta corrected regressions did the main patterns adjust substantially.

[42] In an additional robustness test we restricted the West German sample further to consider only workers who had moved between West German federal states (and jobs). Compared to this potentially highly positively selected group the initial gaps increased for both immigrant groups. The East German gap continued to be smaller than the one for international immigrants.

[43] For a structural model of the return migration decision of international immigrants, see Adda et al. (2022).

potential selection into our sample of East German immigrants.[44] In particular, we present the results for the East German immigrant sample conditional on staying in West Germany for at least 5, 8, or 10 years without intermittent return migration. In Panel A, we find for the SIAB data that the initial gap is smaller and the assimilation rates are reduced by about 50 percent compared to the baseline in column 1 among those who remain in West Germany. This seems to confirm Lubotsky (2007). Those who stay in the sample experienced lower initial gaps (conditional on age, gender, and education) and slower wage assimilation. However, the patterns based on survey data in Panel B differ somewhat. Here, the initial gap only drops somewhat when we condition on remaining in West Germany for at least 10 years whereas the insignificant estimates of the assimilation rates do not respond to sample adjustments. Given the small number of observations these results may be less reliable than those in Panel A. Overall, the results confirm that those with high initial wage gaps and relatively high assimilation rates seem to be the first to drop out from West German full-time employment.[45] Those with stable employment faced smaller initial gaps and smaller average annual wage growth.

Additionally, we know from studies on international immigration to the US that not only selective emigration but also selective labor market participation can affect estimates of labor market integration (e.g., Rho & Sanders 2021). If some immigrant groups are less attached to the labor market their wage assimilation may be delayed. Given that our wage regressions are conditional on labor force participation, **Table 9** shows the initial gap and wage assimilation measures for the East German subsample after conditioning not only on uninterrupted spells in West Germany but also on continuous full-time employment. The results confirm that those remaining in employment for longer suffered the smallest initial wage gaps and featured slower

[44] Fuchs-Schündeln & Schündeln (2009) find that older and single individuals were more likely to return to East Germany than those who were younger and married.

[45] Alternatively, they may have stopped full-time employment due to unemployment or part-time employment, they may have become a civil servant or moved into self-employment.

wage assimilation rates (see, e.g., column 4, Panel A of **Table 9**). While the reduced initial gaps are found with both data sets, again the survey data in Panel B do not yield precise estimates of wage assimilation rates.

Both robustness tests confirm the overall result that the full-time wages of East German immigrants in West Germany are subject to initial wage gaps and only slowly converge to West German native levels. Also, those with the largest initial discounts are the first to leave West German full-time employment.

6.3 Fixed effects estimation

Clearly, besides observable factors such as age at migration, education, and immigration cohort, also unobserved determinants may determine selection into migration and affect labor market outcomes in the destination labor market. We apply fixed effects estimation to test whether the main findings presented so far are robust to selection and unobservable factors. Given fixed effects, it is not possible to control for time-constant characteristics such as an immigrant indicator. In **Table 10** we compare the estimates of the annual wage assimilation in the fixed effects estimation with our baseline results for both the SIAB (see Panel A) and the SOEP (see Panel B) data. In column 2, we offer the fixed effects estimate of the assimilation rate (β_1) based on the model used in **Table 5** (except for the now omitted time-constant immigrant indicator). The previously significantly positive assimilation rate in the SIAB data does not hold up to the control for person-specific unobservables. The estimate is now close to zero and statistically insignificant. The insignificant estimate based on survey data in Panel B dropped in magnitude from 0.3 to 0.2 percent.

To further illustrate the difference in assimilation rates found for the pooled cross-sectional regressions (column 1) and the fixed effects model we re-estimated the fixed effects model after adding interactions of YIWG with educational outcomes. The nature of the estimates in columns 3-5 of **Table 10** are similar across the two datasets: we find that the main

effect in column 3, which describes the East German immigrant subsample without formal educational degrees, yields insignificant negative assimilation rates (significant in panel B). We find insignificant and small effects for immigrants with vocational training degrees (see column 4). In contrast, individuals with tertiary degrees have significantly larger and positive assimilation rates upon entering the West German labor market. This suggests that the positive assimilation rate observed in column one is driven mostly by the positive wage growth of highly educated workers, whereas individuals without formal tertiary degrees do not experience the same wage growth (see also **Figure A.1**).[46]

Overall, we confirm the finding of Kaushal et al. (2016) that cross-sectional estimates overestimate the rate of wage assimilation, possibly due to the effect of selective outmigration. These authors find heterogeneity by immigrant educational attainment which we confirm for our samples, as well.[47] More recently, also Rho & Sanders (2021) study immigrant earnings assimilation for the US, differentiate educational groups, and compare cross-sectional and fixed effects analyses. Their key message is that after controlling for fixed effects particularly the highly educated show strong earnings assimilation. This agrees with our results.

[46] We observe the same patterns of higher assimilation rates among highly educated immigrants also for international immigrants (see **Table A.3**). The education-specific findings for East Germans in **Table 10** are confirmed when we re-estimate the specification of **Table 4** separately by educational degree. With the SIAB data, we find the largest, significant annual assimilation rate of 0.008 for workers with tertiary degrees. In contrast, the estimates were insignificant for those without a degree and smaller but significant for those with only vocational training (0.005). The same holds for the SOEP data, where those without a degree faced significant negative assimilation rates and those with a tertiary degree had the highest positive (though insignificant) average assimilation rate.

[47] In contrast to our results, low-educated immigrants to the U.S. feature the fastest wage growth. The authors suggest that positive selection into migration to the U.S. may be one of the relevant mechanisms. Emmler & Fitzenberger (2020) point out that German East-West migration is generally negatively selected with respect to prior labor market outcomes.

7. Conclusions

We evaluate the wage assimilation of East German immigrants to West Germany after reunification and compare their experience to that of two other groups of immigrants: ethnic Germans, i.e., individuals with historic German roots who arrived in West Germany from former Eastern Bloc countries and international immigrants. Due to the cultural similarity between East and West Germans we expect that East German immigrants assimilate with greater ease to the challenges of the West German labor market than the other two groups. We use both longitudinal survey and administrative data and study the wages of individuals immigrating to West Germany between 1991/92 and 1999.

Our first result is that conditional on age and education East Germans in West Germany on average earned significantly lower wages than native West Germans. The average wage discount of 13 percent compared to natives is substantial but still smaller than that of international immigrants to West Germany with an average discount of at least 20 percent and more than 30 percent among Ethnic Germans. The disadvantage for East Germans in the West German labor market is not in line with the expectation derived from human capital theory that geographic, cultural, and linguistic distance affect assimilation. Given the numerous similarities between East and West Germany, and the easier recognition of East German degrees in West Germany, our result is surprising.

Second, we find that after realizing an initial wage discount immigrants' wages slowly assimilate to those of West German natives over time. Here, again, on average East Germans do not benefit from their cultural similarity relative to international immigrants: based on our administrative data the assimilation rates are identical for the two immigrant groups.

We describe the heterogeneity of these assimilation patterns: the decline in the initial wage gap of East German immigrants over subsequent cohorts matches the real exchange rate mechanism discussed by Dustmann et al. (2023). In contrast, for international immigrants, the initial wage gap increases over time. This may be related to labor market competition

mechanisms discussed by Albert et al. (2022). We find that assimilation rates are highest in the first years after immigration; they are higher among late immigration cohorts and male immigrants; for international immigrants, employment in the more language-intensive tertiary sector is associated with larger initial gaps as is a larger cultural distance to West Germany. Our results are robust with respect to potentially endogenous return migration and selective employment. They hold up when the native sample consists of job starters, only. Finally, estimations with individual fixed effects reveal that positive assimilation for East German and international immigrants was concentrated among highly educated immigrants.

Overall, we find little evidence that the integration of East German immigrants in the West German labor market is substantially smoother than that of Ethnic Germans or international immigrants to West Germany. This is surprising, as East German immigrants benefit from cultural, language, and institutional advantages compared to the other groups. We see three potential explanations for the unexpected disadvantage East Germans face on average in the West German labor market. First, their characteristics may be valued less than those of their West German native peers and therefore earn lower returns; this may affect both observable human capital such as formal educational degrees but also unobservable characteristics. The finding of negative selection into East-West migration as pointed out by Emmler & Fitzenberger (2021) supports this rationale. A second explanation may be that East Germans in West Germany suffer from discrimination. While we are not aware of specific evidence to that effect a recent literature points to the negative labor market effects of dialects both internationally (e.g., Carlson and McHenry 2006 or Yao and van Ours 2019) and specifically for the German case (e.g., Grogger et al. 2020). Grogger et al. (2020) show for Germany that speakers of dialects at times suffer wage disadvantages at the magnitude of the gender wage gap. As some East German dialects may be recognized in West Germany this may contribute to explain labor market disadvantages beyond potential human capital disadvantages. Finally, the cultural similarity between East and West Germans may be smaller and less relevant

than expected. Becker et al. (2020) discuss various differences between the new East and West German regions that predate World War II. In addition, East Germany experienced outmigration of about one-fifth of its original population already before the rise of the iron curtain in 1961. Those remaining in East Germany may differ in observable (e.g., female labor force participation, consumption and saving patterns) and unobservable characteristics (e.g., norms and attitudes such as trust in the state, preferences for redistribution, or religiosity) from their Western counterparts. If these characteristics affect labor market success, then only the mutual language distinguishes East Germans from international immigrants. While this does benefit East German migrants in West Germany it does not suffice to fully balance the native-immigrant gap.

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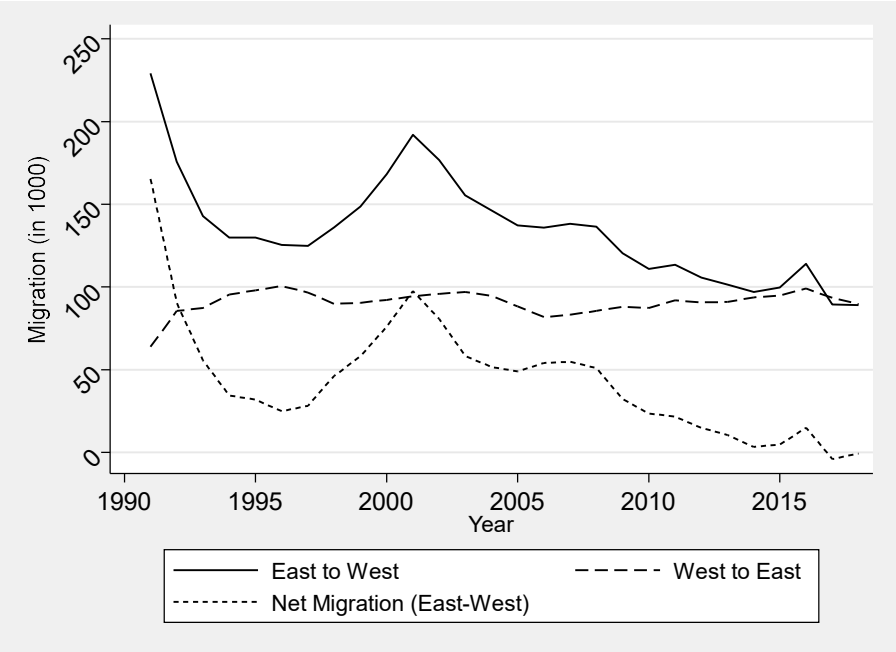
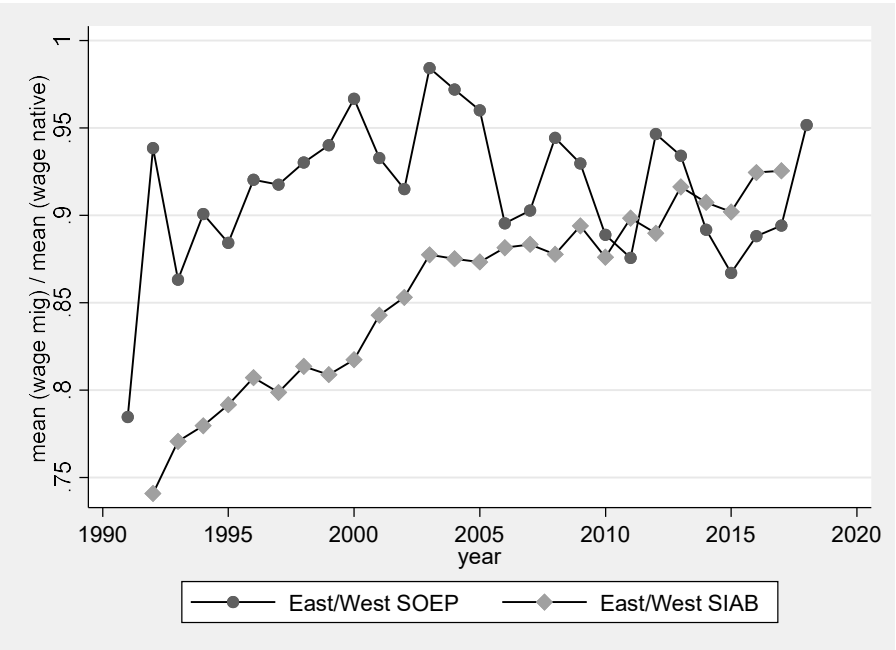
Figure 1 East-West, West-East and net migration in thousands (omitting Berlin), 1991-2018



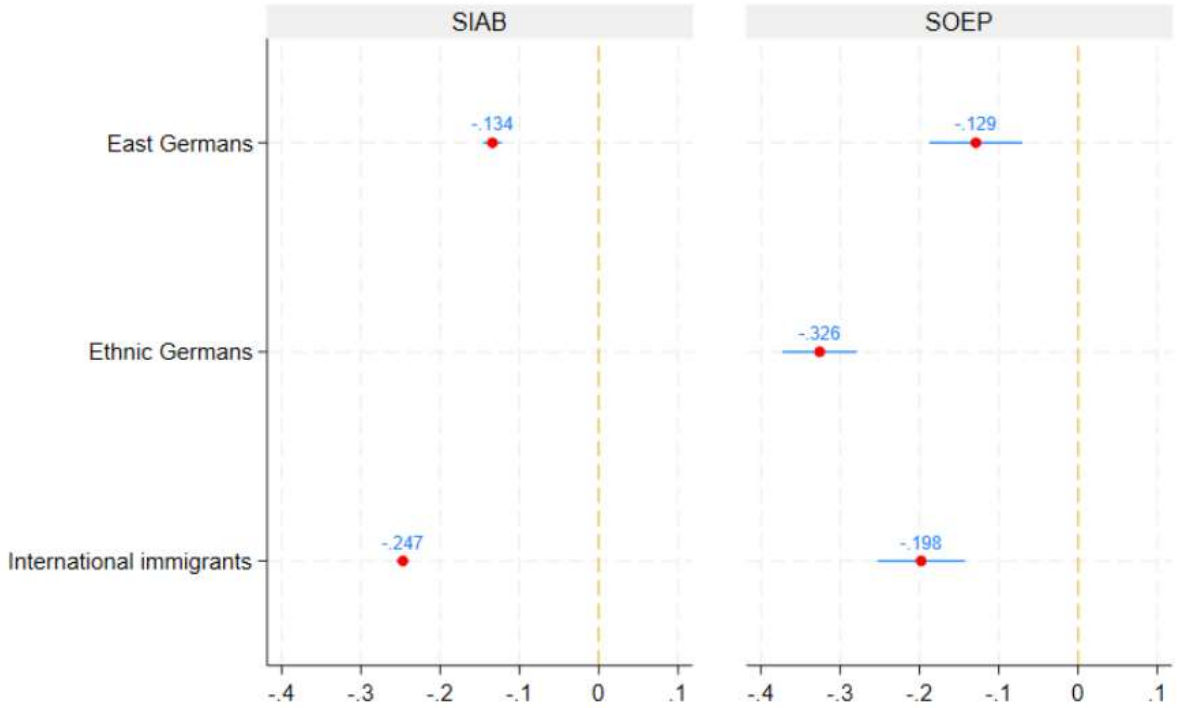
Source: Statistisches Bundesamt (2020).

Figure 2 Ratio of East / West wages in SOEP and SIAB data



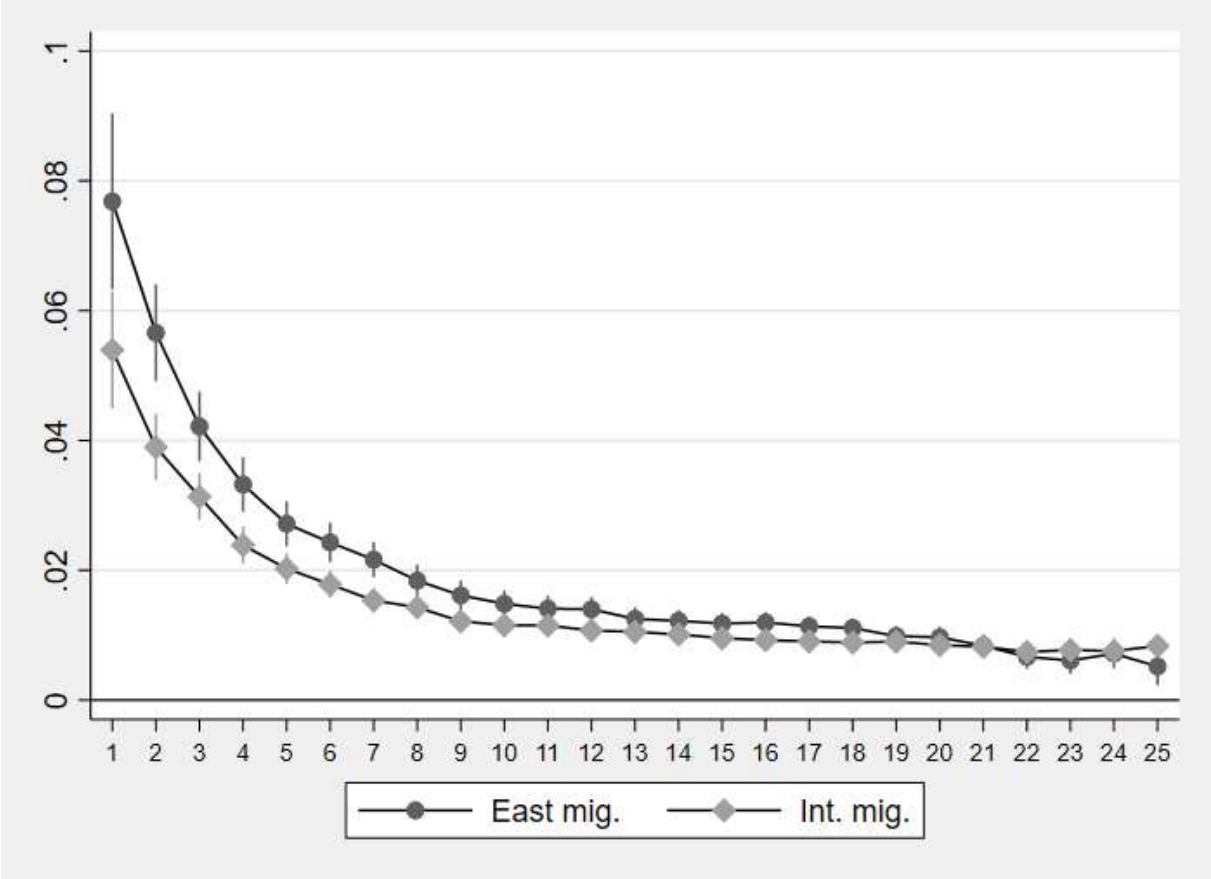
Note: The graph depicts the ratio of immigrant ("mig") to native wages for full-time employed individuals observed in West Germany. In the case of the SOEP data (black dots) we use hourly wages. In the case of the SIAB data (grey diamonds) we use daily wages.
Source: Own calculations.

Figure 3 Average wage differences between immigrant groups and West Germans



Note: The figure shows the estimates of β based on a pooled OLS estimation of equation (1) which were determined comparing each immigrant group from each data set separately to native West Germans (see also **Table A.2** in the appendix). Standard errors clustered at the person level in parentheses. The dependent variables are log real daily (SIAB) or hourly (SOEP) wages. The estimations control for an indicator of gender, two education categories, eight age categories, and year fixed effects. *** p<0.01, ** p<0.05, *p<.10.
Source: Own calculations based on SIAB (1992-2017) and SOEP (1991- 2018).

Figure 4 Coefficient estimates of YIWG splines estimated separately for each year



Notes: The figure depicts coefficient estimates and their confidence bands for every annual value of the number of years lived in West Germany separately. The spline variables in the regression take on the value of the number of years or are coded 0. This replaces the IMM*YIWG controls as presented in **Table 4** (see also **Table A.3** for grouped specifications).

Source: Own calculations based on SIAB (1992-2017).

Table 1 International and domestic migration (in thousands, 1989-2000)

	International Migration			Domestic Migration		
Year	International Migration Net	Ethnic German Migration	Total Net	East-West	West-East	East-West Net
	(1)	(2)	(3)	(4)	(5)	(6)
1989	329	377	594	388	5	383
1990	370	397	682	395	36	359
1991	428	222	602	229	64	165
1992	596	230	782	176	86	90
1993	279	219	462	143	87	56
1994	148	223	315	130	95	34
1995	225	218	498	130	98	32
1996	149	178	282	126	101	25
1997	-22	134	94	125	97	28
1998	-33	103	47	136	90	46
1999	118	105	202	149	91	58
2000	86	95	167	168	92	76

Notes: Column (1) shows net immigration of foreign citizens (including asylum seekers, excluding ethnic Germans). Column (3) shows net immigration across borders including that of native German citizens which is not presented separately. Columns (4)-(6) include movers from and to East Berlin.
Source: Information in columns (1)-(3): Bauer et al. (2005, p. 202), information in columns (4)-(6) for 1989 and 1990 is from Wolff (2007), for 1991-2000 is from Statistisches Bundesamt (2020).

Table 2 Descriptive statistics (mean values) - SOEP Data

	(1) East Germans	(2) Ethnic Germans	(3) International immigrants	(4) West Germans
Hourly real gross wage (in 2005 Euro)	14.95	11.28	12.89	15.64
Log hourly real gross wage (in 2005 Euro)	2.61	2.38	2.47	2.66
Female (0/1)	0.35	0.31	0.21	0.28
Age	41.74	44.32	39.51	42.65
YIWG (Years in West Germany)	8.17	10.71	10.43	0.00
Educ: no vocat. training (0/1)	0.02	0.15	0.23	0.06
Educ: vocat. training (0/1)	0.60	0.66	0.54	0.74
Educ: tertiary degree (0/1)	0.37	0.19	0.23	0.20
Immigration year 90-91 (0/1)	0.37	0.36	0.51	0.00
Immigration year 92-93 (0/1)	0.27	0.32	0.25	0.00
Immigration year 94-95 (0/1)	0.15	0.21	0.13	0.00
Immigration year 96-97 (0/1)	0.09	0.09	0.06	0.00
Immigration year 98-99 (0/1)	0.12	0.02	0.06	0.00
Age at migration 21-30 (0/1)	0.46	0.40	0.67	0.00
Age at migration 31-40 (0/1)	0.34	0.42	0.26	0.00
Age at migration 41-50 (0/1)	0.18	0.16	0.06	0.00
Age at migration 51-60 (0/1)	0.02	0.02	0.01	0.00
Public sector (0/1)	0.18	0.09	0.14	0.27
Northern Germany (0/1)	0.49	0.67	0.44	0.48
Person-year observations	1,417	1,205	1,283	44,738
Person observation	160	162	213	4,602

Note: The sample consists of full-time employed individuals in West Germany.
Source: Own calculations based on SOEP, years 1991-2018.

Table 3 Descriptive statistics (mean values) - SIAB Data

	(1) East Germans	(2) International immigrants	(3) West Germans
Daily real gross wage (in 2005 Euro)	107.85	93.03	123.55
Log daily real gross wage (in 2005 Euro)	4.58	4.41	4.71
Female (0/1)	0.33	0.27	0.32
Age	40.14	38.60	41.80
Age 21-25 (0/1)	0.07	0.06	0.06
Age 26-30 (0/1)	0.13	0.15	0.11
Age 31-35 (0/1)	0.16	0.19	0.14
Age 36-40 (0/1)	0.17	0.19	0.15
Age 41-45 (0/1)	0.16	0.18	0.15
Age 46-50 (0/1)	0.13	0.12	0.14
Age 51-55 (0/1)	0.10	0.07	0.13
Age 56-60 (0/1)	0.06	0.03	0.09
Age 61-65 (0/1)	0.02	0.01	0.03
YIWG (Years in West Germany)	8.39	8.72	0.00
Educ: No vocat. training (0/1)	0.02	0.34	0.06
Educ: Vocational training (0/1)	0.81	0.53	0.80
Educ: Tertiary degree (0/1)	0.17	0.13	0.14
Immigration year 92-93 (0/1)	0.27	0.38	0.00
Immigration year 94-95 (0/1)	0.20	0.24	0.00
Immigration year 96-97 (0/1)	0.20	0.18	0.00
Immigration year 98-99 (0/1)	0.33	0.21	0.00
Age at migration 21-30 (0/1)	0.55	0.38	0.00
Age at migration 31-40 (0/1)	0.30	0.24	0.00
Age at migration 41-50 (0/1)	0.13	0.18	0.00
Age at migration 51-60 (0/1)	0.02	0.21	0.00
Cohort (immigration year 92-99 = 1-8)	4.69	3.91	0.00
AgeMig (age at migration)	31.01	28.99	0.00
Public sector (0/1)	0.15	0.10	0.16
High-skilled (0/1)	0.21	0.14	0.24
Person-year observations	38,200	121,105	5,739,853
Person observation	4,069	16,318	480,593

Note: The sample consists of full-time employed individuals in West Germany.
Source: Own calculations based on SIAB, years 1992-2017.

Table 4 Separating initial gap and annual assimilation effects

	SIAB	SIAB	SOEP	SOEP	SOEP
	(1)	(2)	(3)	(4)	(5)
	East Germans	International immigrants	East Germans	Ethnic Germans	International immigrants
Imm	-0.182 ***	-0.299 ***	-0.150 ***	-0.290 ***	-0.164 ***
	(0.006)	(0.004)	(0.029)	(0.032)	(0.037)
Imm * YIWG	0.006 ***	0.006 ***	0.003	-0.003	-0.003
	(0.0006)	(0.0004)	(0.003)	(0.003)	(0.004)
N	5,778,053	5,860,958	46,155	45,943	46,021

Notes: Standard errors clustered at the person level in parentheses; pooled OLS; dependent variable log real daily (SIAB) or hourly (SOEP) wages; estimations control for an indicator of gender, two education categories, eight age categories, year fixed effects. The coefficient estimate for the variable Imm indicates the initial wage gap upon immigration and the coefficient estimate for the variable Imm*YIWG reflects the average annual assimilation effect. *** p<0.01, ** p<0.05, *p<.10.
Source: Own calculations based on SIAB (1992-2017) and SOEP (1991- 2018).

Table 5 Effect heterogeneity by cohort, age at migration, gender, and sector

	SIAB (1) East Germans	SIAB (2) Internat. immigrants	SIAB (3) East Germans	SIAB (4) Internat. immigrants	SIAB (5) East Germans	SIAB (6) East Germans
Imm	-0.232 ***	-0.275 ***	0.178 ***	-0.003	-0.240 ***	-0.211 ***
	(0.013)	(0.007)	(0.021)	(0.016)	(0.007)	(0.007)
Imm*YIWG	0.003 ***	0.004 ***	0.0007	0.002	0.007 ***	0.006 ***
	(0.001)	(0.0007)	(0.003)	(0.002)	(0.0007)	(0.0007)
Female	-0.283 ***	-0.282 ***	-0.283 ***	-0.282 ***	-0.284 ***	-0.279 ***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Cohort*Imm	0.009 ***	-0.007 ***	-	-	-	-
	(0.002)	(0.002)				
Cohort*Imm*YIWG	0.0008 ***	0.0007 ***	-	-	-	-
	(0.0002)	(0.0002)				
AgeMig*Imm	-	-	-0.011 ***	-0.010 ***	-	-
			(0.0007)	(0.0005)		
AgeMig*Imm*YIWG	-	-	0.0001	0.0001	-	-
			(0.0001)	(0.0001)		
Female*Imm	-	-	-	-	0.169 ***	-
					(0.014)	
Female*Imm*YIWG	-	-	-	-	-0.002 *	-
					(0.001)	
Public	-	-	-	-	-	-0.023 ***
						(0.001)
Public*Imm	-	-	-	-	-	0.201 ***
						(0.017)
Public*Imm*YIWG	-	-	-	-	-	-0.002
						(0.002)
N	5,778,053	5,860,958	5,778,053	5,860,958	5,778,053	5,778,053

Notes: see **Table 4**. The variable *Cohort* is coded 1 for immigration year 1992, 2 for immigration year 1993, etc. up to 8 for immigration year 1999. The variable *AgeMig* is a linear measure of an individual's age migration.
Source: Own calculations based on SIAB (1992-2017).

Table 6 Effect heterogeneity by skill level, tertiary sector and cultural distance

	SIAB (1) East Germans		SIAB (2) Internat. immigrants		SIAB (3) East Germans		SIAB (4) Internat. immigrants		SIAB (5) Internat. immigrants	
Imm	-0.152	***	-0.301	***	-0.210	***	-0.252	***	-0.154	***
	(0.007)		(0.004)		(0.009)		(0.005)		(0.012)	
Imm*YIWG	0.004	***	0.006	***	0.0043	***	0.002	***	0.005	***
	(0.0007)		(0.0004)		(0.001)		(0.0002)		(0.001)	
Female	-0.267	***	-0.266	***	-0.270	***	-0.268	***	-0.283	***
	(0.001)		(0.001)		(0.001)		(0.001)		(0.001)	
HighSkill	0.291	***	0.291	***	-		-		-	
	(0.001)		(0.001)							
HighSkill*Imm	-0.112	***	0.075	***	-		-		-	
	(0.017)		(0.013)							
HighSkill*Imm*YIWG	0.011	***	0.005	***	-		-		-	
	(0.002)		(0.001)							
Tertiary	-		-		-0.046	***	-0.046	***	-	
					(0.001)		(0.001)			
Tertiary*Imm	-		-		0.048	***	-0.074	***	-	
					(0.012)		(0.007)			
Tertiary*Imm*YIWG	-		-		0.002	*	0.007	***	-	
					(0.001)		(0.0007)			
Cult.Dist.*Imm	-		-		-		-		-0.067	***
									(0.006)	
Cult.Dist.*Imm*YIWG	-		-		-		-		0.002	***
									(0.001)	
N	5,778,053		5,860,958		5,776,485		5,859,367		5,781,225	

Notes: see **Table 4**. The variable *HighSkill* is indicates whether individuals work in an occupation with high levels of complexity. The variable *Tertiary* indicates whether individual work in the tertiary sector. The variable *Cult.Dist* indicates cultural distance of international immigrants to West Germans.
Source: Own calculations based on SIAB (1992-2017).

Table 7 Robustness to an alternative native sample - only job starters

	SIAB	SIAB	SOEP	SOEP	SOEP
	(1)	(2)	(3)	(4)	(5)
	East Germans	International immigrants	East Germans	Ethnic Germans	International immigrants
Imm	-0.135 ***	-0.248 ***	-0.109 ***	-0.238 ***	-0.133 ***
	(0.006)	(0.004)	(0.029)	(0.033)	(0.038)
Imm * YIWG	0.004 ***	0.004 ***	0.002	0.005	-0.004
	(0.0006)	(0.0004)	(0.003)	(0.003)	(0.004)
N	3,569,066	3,651,971	23,708	23,496	23,574

Notes: see **Table 4**.
Source: Own calculations based on SIAB (1992-2017) and SOEP (1991- 2018).

Table 8 Robustness to Return Migration - East German Immigrants

Panel A: SIAB	(1)	(2)	(3)	(4)
		First spell in West Germany lasts at least …		
	Baseline	5 years	8 years	10 years
Imm	-0.182 ***	-0.129 ***	-0.122 ***	-0.116 ***
	(0.006)	(0.008)	(0.009)	(0.009)
Imm * YIWG	0.006 ***	0.003 ***	0.003 ***	0.002 ***
	(0.0006)	(0.0007)	(0.0007)	(0.0007)
N	5,778,053	5,767,810	5,766,025	5,764,901
Panel B: SOEP	(1)	(2)	(3)	(4)
		First spell in West Germany lasts at least …		
	Baseline	5 years	8 years	10 years
Imm	-0.150 ***	-0.157 ***	-0.155 ***	-0.134 ***
	(0.029)	(0.033)	(0.034)	(0.035)
Imm * YIWG	0.003	0.003	0.003	0.002
	(0.003)	(0.003)	(0.003)	(0.003)
N	46,155	46,020	45,924	45,854

Notes: see **Table 4**. The baseline results in column 1 are replicated from **Table 4**. Columns 2-4 use only observations for whom the first observed spell in West Germany lasted at least 5, 8, or 10 years.

Source: Own calculations based on SIAB (1992-2017) and SOEP (1991- 2018).

Table 9 Robustness to Return Migration and Employment - East German Immigrants

Panel A: SIAB	(1)	(2)	(3)	(4)
		First spell in West Germany and full-time employment last at least …		
	Baseline	5 years	8 years	10 years
Imm	-0.182 ***	-0.162 ***	-0.152 ***	-0.145 ***
	(0.006)	(0.009)	(0.010)	(0.010)
Imm * YIWG	0.006 ***	0.003 ***	0.003 ***	0.002 ***
	(0.0006)	(0.0008)	(0.0007)	(0.0007)
N	5,778,053	4,591,147	4,589,864	4,589,073
Panel B: SOEP	(1)	(2)	(3)	(4)
		First spell in West Germany and full-time employment last at least …		
	Baseline	5 years	8 years	10 years
Imm	-0.150 ***	-0.106 **	-0.093 **	-0.074
	(0.029)	(0.045)	(0.046)	(0.045)
Imm * YIWG	0.003	0.006	0.005	0.004
	(0.003)	(0.005)	(0.005)	(0.004)
N	46,155	20,385	20,323	20,287

Notes: see **Table 4**. The baseline results in column 1 are replicated from **Table 4**. Columns 2-4 use only those observations for whom the first observed spell in West Germany lasted at least 5, 8, or 10 years during which the person was full-time employed.

Source: Own calculations based on SIAB (1992-2017) and SOEP (1991- 2018).

Table 10 Fixed Effects estimation - East German Immigrants

Panel A: SIAB	(1)	(2)	(3)	(4)	(5)
	OLS	FE	FE with education interactions		
	Baseline			…*vocat	…*tertiary
Imm * YIWG	0.006 ***	0.00016	-0.003	0.0014	0.0133 ***
	(0.0006)	(0.0005)	(0.0027)	(0.0027)	(0.0029)
N	5,778,053	5,778,053		5,778,053	

Panel B: SOEP	(1)	(2)	(3)	(4)	(5)
	OLS	FE	FE with education interactions		
	Baseline			…*vocat	…*tertiary
Imm * YIWG	0.003	0.002	-0.007 ***	0.003	0.018 ***
	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)
N	46,155	46,155		46,155	

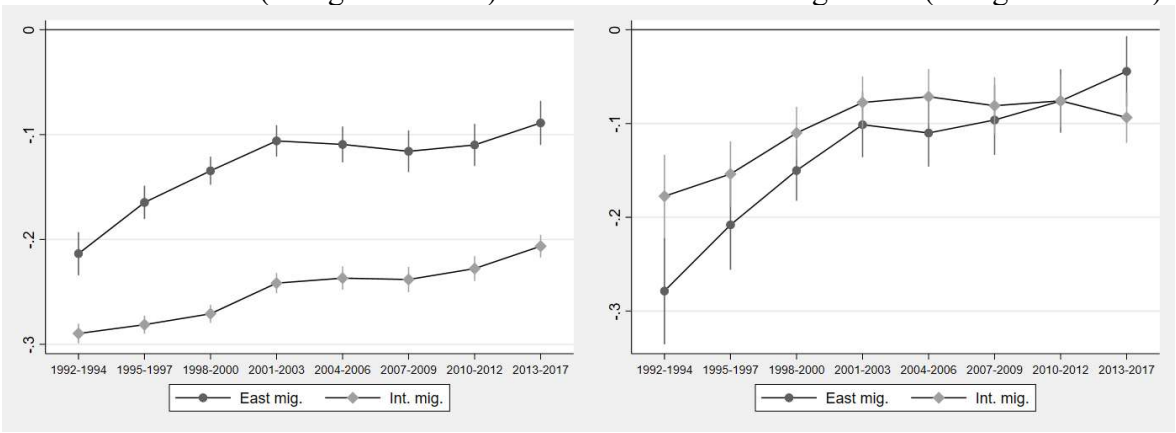
Notes: see **Table 4**. The baseline results in column 1 are replicated from **Table 4**. Column 2 shows the estimation results from a fixed effects estimation using the model as in column1 (except for time-constant immigrant indicator). The estimates in columns 3-5 show the main and interaction effects that results when Imm * YIWG (column 3) is additionally interacted with vocational training degree (column 4) and with tertiary degree (column 5). The specification also controls for age, year, and education main effects as the previous model.

Source: Own calculations based on SIAB (1992-2017) and SOEP (1991- 2018).

Appendix

Figure A.1 Average wage differences between immigrant groups and West Germans over time by job complexity

Panel A: Low-Skill (Categories 1 & 2) Panel B: High-Skill (Categories 3 & 4)



Source: Own calculations using SIAB data, years 1992-2017.

Table A.1 Descriptive statistics (mean value) – SIAB Data

	(1) East Germans	(2) Int. immigrants	(3) West Germans
First state of residence:			
Schleswig-Holstein	0.07	0.02	0.04
Hamburg	0.06	0.04	0.04
Lower Saxony	0.17	0.07	0.11
Bremen	0.01	0.01	0.01
North Rhine-Westphalia	0.16	0.24	0.27
Hesse	0.11	0.12	0.10
Rhineland-Palatinate	0.04	0.05	0.06
Baden-Wuerttemberg	0.13	0.20	0.17
Bavaria	0.25	0.23	0.19
Saarland	0.01	0.02	0.02
First industry (1-digit):			
Agriculture, forestry, mining	0.02	0.04	0.02
Manufacturing, energy, water supply	0.20	0.21	0.32
Construction	0.16	0.14	0.08
Wholesale and retail trade; repair of vehicles	0.14	0.11	0.16
Hotels and restaurants	0.04	0.16	0.02
Transportation and communication	0.07	0.05	0.05
Financial intermediation	0.02	0.01	0.04
Real estate activities	0.19	0.14	0.10
Public admin., defense, social security	0.02	0.01	0.05
Education and teaching	0.02	0.02	0.02
Health, veterinary and social services	0.10	0.06	0.10
Other services, Private households	0.03	0.05	0.04
First occupation:			
AGR-Agricultural occupations	0.01	0.04	0.01
EMB-Simple manual occupations	0.15	0.23	0.13
QMB-Qual. manual occupations	0.23	0.22	0.18
TEC-Technicians	0.04	0.02	0.06
ING Engineers	0.04	0.02	0.04
EDI-Simple services	0.15	0.24	0.11
QDI-Qual. Services	0.04	0.04	0.05
SEMI semiprofessionals	0.08	0.03	0.06
PROF-Professionals	0.02	0.02	0.02
EVB-Simple commercial and admin. professions	0.08	0.05	0.09
QVB-Qual. commercial and admin. professions	0.14	0.08	0.23
MAN Manager	0.02	0.02	0.03

Note: See **Table 3**.
Source: Own calculations based on SIAB, years 1992-2017.

Table A.2 Average wage differences between immigrant groups and West Germans

	SIAB (1) East Germans	SIAB (2) International immigrants	SOEP (3) East Germans	SOEP (4) Ethnic Germans	SOEP (5) International immigrants
Imm	-0.134 ***	-0.247 ***	-0.129 ***	-0.326 ***	-0.198 ***
	(0.006)	(0.004)	(0.030)	(0.024)	(0.028)
N	5,778,053	5,860,958	46,155	45,943	46,021

Notes: Standard errors clustered at the person level in parentheses; pooled OLS; dependent variable log real daily (SIAB) or hourly (SOEP) wages; estimations control for an indicator of gender, two education categories, eight age categories, year fixed effects. *** p<0.01, ** p<0.05, *p<.10.
Source: Own calculations based on SIAB (1992-2017) and SOEP (1991- 2018).

Table A.3 Effect heterogeneity over duration of stay

	SIAB (1) East Germans	SIAB (2) International immigrants
Imm	-0.233 ***	-0.325 ***
	(0.006)	(0.004)
Imm*YIWG (1-5)	0.021 ***	0.017 ***
	(0.001)	(0001)
Imm*YIWG (6-10)	0.012 ***	0.010 ***
	(0.001)	(0.001)
Imm*YIWG (11-15)	0.009 ***	0.008 ***
	(0.001)	(0.000)
Imm*YIWG (16-20)	0.008 ***	0.007 ***
	(0.001)	(0.000)
Imm*YIWG (21-25)	0.005 ***	0.006 ***
	(0.001)	(0.000)
N	5,778,053	5,860,958

Notes: see **Table 4**. The YIWG indicators used here represent the number of years in West Germany separately for different value ranges. They are coded 0 otherwise. Therefore, the coefficients indicate average returns to staying in West Germany over different numbers of years.

Source: Own calculations based on SIAB (1992-2017).

Table A.4 Separating initial gap and annual assimilation effects using second and third order polynomials in YIWG

	SIAB (1) East Germans	SIAB (2) International immigrants	SIAB (3) East Germans	SIAB (4) International immigrants
Imm	-0.212 ***	-0.313 ***	-0.225 ***	-0.327 ***
	(0.0065)	(0.0040)	(0.0065)	(0.0041)
Imm * YIWG	0.016 ***	0.011 ***	0.024 ***	0.0199 ***
	(0.0016)	(0.0010)	(0.0026)	(0.0017)
Imm * YIWG^2	-0.0005 ***	-0.0002 ***	-0.0015 ***	-0.0013 ***
	(0.0001)	(0.00004)	(0.0003)	(0.0002)
Imm * YIWG^3	-	-	0.00003 ***	0.00003 ***
			(0.00001)	(0.00001)
N	5,778,053	5,860,958	5,778,053	5,860,958

Notes: see **Table 4**. The specifications add controls for squared and cubic values of YIWG to the models presented in columns (1) and (2) of **Table 4**.

Source: Own calculations based on SIAB (1992-2017).

Table A.5 Fixed Effects estimation - International Immigrants

Panel A: SIAB	(1) OLS Baseline	(2) FE	(3) FE with education interactions	(4) …*vocat	(5) …*tertiary
Imm * YIWG	0.006 ***	0.0018 ***	-0.001	0.0014 **	0.0147 ***
	(0.0004)	(0.0003)	(0.0005)	(0.0006)	(0.0011)
N	5,860,958	5,860,958		5,860,958	
Panel B: SOEP	**(1) OLS Baseline**	**(2) FE**	**(3) FE with education interactions**	**(4) …*vocat**	**(5) …*tertiary**
Imm * YIWG	-0.003	-0.006 *	-0.011 *	0.002	0.017 **
	(0.003)	(0.003)	(0.006)	(0.007)	(0.008)
N	46,021	46,021		46,021	

Notes: see **Table 4**. The baseline results in column 1 are replicated from **Table 4**. Column 2 shows the estimation results from a fixed effects estimation using the model as in column1 (except for time-constant immigrant indicator). The estimates in columns 3-5 show the main and interaction effects that results when *Imm * YIWG* (column 3) is additionally interacted with vocational training degree (column 4) and with tertiary degree (column 5). The specifications in column 2 and 3-5 also control for age, year, and education main effects model.

Source: Own calculations based on SIAB (1992-2017) and SOEP (1991- 2018).