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Transferability of Human Capital and Immigrant Assimilation: An Analysis for Germany

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Abstract. This paper investigates the transferability of human capital across countries and the contribution of imperfect human capital portability to the explanation of the immigrant-native wage gap. Using data for West Germany, our results reveal that, overall, education and in particular labor market experience accumulated in the home countries of the immigrants receive significantly lower returns than human capital obtained in Germany. We further find evidence for heterogeneity in the returns to human capital of immigrants across countries. Finally, imperfect human capital transferability appears to be a major factor in explaining the wage differential between natives and immigrants.

JEL-Classification: J61, J31, J24

Keywords: Human Capital, Rate of Return, Immigration, Assimilation

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1 Introduction

The existing literature on the economic performance of immigrants concentrates on the wage differential between migrants and natives with comparable characteristics. The common framework of these analyses is the human capital theory, wherein wage disparities between groups are attributed to the mean differences in productivity-relevant characteristics. Following Chiswick (1978) and Borjas (1985), numerous studies have shown that immigrants have an earnings disadvantage upon arrival in the destination country, which is explained by the immigrant's lack of human capital that is specifically suited to the labor market of the receiving country. With time of residence in the host country, however, they accumulate country-specific human capital, thereby narrowing the initial earnings gap.

The majority of the existing studies on the wage assimilation of immigrants treat education and labor market experience obtained in different countries as perfect substitutes. Studies on educational mismatch of immigrants usually also treat education obtained in the home country to be comparable to education obtained in the receiving country (Duncan & Hoffman, 1981; Korpi & Tï¿½hlin, 2009). These studies ignore the possibility that skills valuable in one labor market may not raise productivity in another labor market (Schmidt, 1997), and hence may not be rewarded equally in terms of earnings. Only a few studies allow the returns to human capital to vary not only for immigrants and natives, but also according to where the human capital has been obtained. Distinguishing between foreign and domestic education and allowing for their rates of return to differ, Schoeni (1997) and Bratsberg & Ragan (2002) find that the returns to education for immigrants with US schooling are substantially higher than for those who only have foreign schooling.

Some studies allow the returns to schooling and labor market experience to both vary (Beggs & Chapman, 1988; Kossoudji, 1989; Friedberg, 2000; Schaafsma & Sweetman, 2001; Sanromá et al., 2009). The results of Kossoudji (1989), for example, indicate almost zero returns to labor market experience accumulated outside the US and small difference in the returns to pre- and post-immigration schooling. Studying immigrants in Canada, Schaafsma & Sweetman (2001) confirm that work experience from abroad yields virtually no return and, in addition, find that the return to education varies with age at immigration. Friedberg (2000) finds that education and

labor market experience acquired abroad are significantly less valued than human capital obtained in Israel, and that this difference can fully account for the earnings disadvantage of immigrants relative to their Israeli counterparts. Cohen-Goldner & Eckstein (2008) confirm the results of Friedberg (2000), finding substantial returns to training and experience undertaken by immigrants in Israel and zero returns to imported skills. Similar patterns of the returns to education obtained in different countries also appear in Spain (Sanromá et al., 2009). Chiswick & Miller (2009) argue that the development of educational mismatch among immigrants in the US may be explained by imperfect international transferability of skills obtained pre-immigration.

Germany, a major immigrant destination in the European Union, represents an excellent case study for the investigation of the transferability of human capital across countries. The history of immigration to Germany has generated different types of migrants in terms of their human capital composition. For almost a decade until the early 1970s, a large number of guest-workers were encouraged to migrate to Germany as a reaction to a perceived shortage of unskilled labor. At the time of immigration, most of the guest-workers had already completed their schooling and accumulated some labor market experience in their home countries. In addition, since the work arrangement under the guest-worker program was intended to be predominantly temporary, these immigrants did not have pronounced incentives to invest in German-specific human capital. However, many of them ended up staying in Germany permanently.

As the recruitment of guest-workers was stopped in 1973, family reunification, humanitarian immigration in the form of asylum seekers and war refugees, and the immigration of ethnic Germans from Eastern Europe became the major avenues of legal immigration to Germany thereafter (Schmidt & Zimmermann, 1992; Fertig & Schmidt, 2001; Bauer et al., 2005). Some of these immigrants entered at very young ages and were likely to have obtained virtually all of their skills in Germany or have a combination of foreign- and domestically-acquired human capital. Furthermore, with the series of expansions of the European Union, labor mobility within Europe has been made easier, and more recently, programs were implemented to encourage the admission of highly-skilled professionals (Martin, 2002). In short, the different immigration regimes have brought forth immigrants who vary in the configurations

of the regional sources of their human capital allowing us to gain further insights on the role of human capital transferability to explain the native-immigrant wage gap.

In this paper, we investigate whether human capital accumulated in different countries are rewarded differently in the German labor market – an aspect that hitherto has not been dealt with. Using data from the German Socio-Economic Panel (SOEP), we are able to approximate the years of education and labor market experience undertaken abroad and in Germany in order to analyze this issue. While most of the earlier studies only consider male immigrants, we also carry out the analysis for females. Given the immigration history of Germany, we examine immigrants by region of origin, arrival cohort and whether they consider themselves as temporary or permanent migrants.

Our results suggest that the native-immigrant earnings gap at the time of arrival can largely be explained by the different regional sources of human capital. Overall, education and labor market experience obtained outside of Germany receive significantly lower returns than human capital obtained in Germany. We further find evidence for heterogeneity in the returns to human capital of immigrants across origin countries, with immigrants from countries that are very similar to Germany with respect to their level of economic development earning similar returns than natives.

The paper is structured as follows. Section 2 describes the data set and discusses the empirical strategy. Section 3 presents the basic estimation results, while Section 4 investigates heterogeneity in the returns to human capital in more detail. Section 5 concludes.

2 Empirical Strategy and Data

2.1 Empirical Strategy

Following the seminal paper on immigrants' earnings assimilation by Chiswick (1978), we estimate wage equations of the form:

$$w_{i,t} = \beta_0 + \beta_1 S_{i,t} + \beta_2 EXP_{i,t} + \beta_3 I_i + \beta_4 YSM_{i,t} + \beta_5' X_{i,t} + \epsilon_{i,t}, \quad (1)$$

for i=1,..., N and t=1,...,T. Where $w_{i,t}$ represents the log real hourly gross wage of individual i, $S_{i,t}$ refers to years of schooling, $EXP_{i,t}$ to years of potential labor market experience, and $YSM_{i,t}$ to the number of years since an immigrant's arrival in Germany. As we are going to use panel data rather than cross sectional data, the subscript t denotes the respective year. I_i is a dummy variable of the individuals' immigrant status. In equation (1), the coefficient β_3 shows the wage gap between immigrants and comparable natives upon the arrival of the immigrants in Germany. The coefficient β_4 captures the rate at which this native-immigrant wage gap diminishes with time of residence in Germany. Other individual characteristics that potentially affect the wage are subsumed in the vector $X_{i,t}$. It includes information on the individual's marital status and number of children, state of residence and industry of employment. Since we apply pooled Ordinary Least Squares (OLS) to panel data covering the period 1984-2012, $X_{i,t}$ also includes a set of year-specific effects, which are assumed to be the same for both natives and immigrants. While most of the literature focus on the wage assimilation of male immigrants, we carry out our analysis for both males and females.

Based on the standard specification shown in equation (1) it is not possible to estimate different returns to foreign and domestic human capital because human capital ($S_{i,t}$ and $EXP_{i,t}$) acquired by immigrants in their home and host countries is treated as homogeneous. As Friedberg (2000) points out, equation (1) makes several restrictive implicit assumptions. It is assumed that the returns to immigrants' education and labor market experience obtained abroad equal the returns to education and labor market experience they accumulate in the destination country. This in turn implies two things. First, the *relative* return to immigrants' human capital obtained in their home and in the host country is the same for education and experience. Second, the returns to human capital obtained in the destination country are assumed to be equal for both, natives and immigrants. There are several arguments why these assumptions may not hold.

Firstly, the quality of education varies substantially across countries (Friedberg, 2000). Education acquired in poorer countries may obtain lower returns in the host country as this education may be of (real or perceived) lower quality due to limited resources that these countries are able to devote to their educational systems. As a consequence of the various immigration regimes, for example, the non-German

born population is a mixture of immigrants who originated from countries that are highly diverse in terms of their levels of economic development, as well as linguistic, institutional and cultural backgrounds. Secondly, training and work experience accumulated in less developed economies may not be suited to the needs of the often more technologically-advanced labor markets of the host countries. Hence, training and work experience obtained abroad may be discounted compared to human capital collected in the host country. Thirdly, the returns to education and experience acquired in the host country, on the other hand, may be lower or higher for immigrants than natives. As Friedberg (2000) asserts, since natives have country-specific skills – predominantly greater proficiency in the language – each year of education or experience could translate to an earnings potential higher than what immigrants could achieve. On the other hand, immigrants may get additional benefits in terms of language training, familiarization with institutions, work etiquettes, etc. Therefore, each year of German schooling or experience could have compounded benefits.

To relax the above-mentioned restrictions, we follow Friedberg (2000) and estimate the following model:

$$\begin{aligned} w_{i,t} &= \gamma_0 + \gamma_1 I_i + \gamma_2 S^f_{i,t} + \gamma_3 S^d_{i,t} + \gamma_4 (S^d_{i,t} * I_i) \\ &\quad + \gamma_5 EXP^f_{i,t} + \gamma_6 EXP^d_{i,t} + \gamma_7 (EXP^d_{i,t} * I_i) + \gamma'_8 X_{i,t} + \varepsilon_{i,t}, \end{aligned} \tag{2}$$

where the superscripts f and d refer to foreign- and domestically-acquired human capital, respectively, and t to the point in time. This model allows the returns to foreign- and domestically-acquired human capital to vary. Based on estimations of equations (1) and (2), one can test the validity of the various implicit restrictions of equation (1) discussed above. We test for each specification, whether the returns to education (experience) obtained in the home country are significantly different from the returns to education (experience) acquired in the host country. A more comprehensive model also allows for interaction effects where the returns to foreign human capital are allowed to vary with the accumulation of domestic human capital. We will present results of such a specification in Section 4.

2.2 Data Description

The data used in this study are drawn from the German Socio-Economic Panel (SOEP) for the years 1984 to 2012.[1] We define immigrants as persons who were born outside Germany and immigrated after 1948. Table A1 provides an overview of the defined variables. As immigrants living in East Germany comprise less than two percent of the population, we restrict our analysis to West Germany. We further restrict our sample to individuals aged 16 to 64 years who are in wage and salaried employment and excluded those who are in the military or civil service or undergoing full-time training. Unlike previous studies, which focus only on male immigrants, we also examine the assimilation of female immigrants. Pooled OLS estimations are implemented for full-time workers, separately by gender.[2]

After applying our selection criteria, we are left with 110,057 person-year observations of full-time workers (18,481 unique respondents), of which 69% are males. Immigrants comprise about 21% of the sample for either gender. We categorize immigrants into regions of origin, namely: high-income OECD[3], Turkey, Eastern Europe and the former Soviet Union (fSU), Ex-Yugoslavia, and a heterogeneous group *Others*, which consists of immigrants coming from countries other than the four regions specified. We further split the sample into three immigration cohorts: pre-1974, which is predominantly a period of manpower recruitment; 1974-1988, an era in which mainly family migrants entered Germany; and 1989-2011, which covers

[1]The data used in this paper were extracted using the Add-On package PanelWhiz v4.0 (Oct 2012) for Stata. PanelWhiz was written by Dr. John P. Haisken-DeNew (john@panelwhiz.eu). The PanelWhiz generated DO file to retrieve the SOEP data used here and any Panelwhiz Plugins are available upon request. Any data or computational errors in this paper are our own. Haisken-DeNew & Hahn (2010) describe PanelWhiz in detail.

[2]In carrying out OLS estimations, we took into account the survey design of the dataset. Since we observe an individual multiple times, there is obviously a violation of independence among observations. We address this issue by clustering our estimations at the individual level. This adjusts the error term to the lack of independence without explicitly modeling the correlation among individuals.

[3]This excludes Mexico (not a high-income OECD country as based on the World Bank (2011) classification of economies) and Turkey as well as Slovakia, Poland, Hungary and the Czech Republic (respectively own categories).

the period of the dissolution of socialism and its aftermath, which was characterized mainly by the immigration of ethnic Germans from Eastern Europe, asylum seekers and war refugees. Finally, we classify immigrants as permanent and temporary migrants based on whether or not they claim that they wish to stay permanently in Germany in the three years preceding the respective survey year.

In constructing our dependent variable, log real hourly wages, we use information on individuals gross monthly wages and weekly hours of work (contractual working hours if available, otherwise self-reported working hours by the respondents). We take the reported completed years of schooling as the measure of education. In order to disaggregate the years of schooling obtained in the country of origin and in Germany, we follow the procedure of Friedberg (2000), i.e. we assume that children start school at age six and undertake education continuously until they complete their total years of schooling. Since we know the age at which the immigrant arrived in Germany, we can calculate the years of schooling that would have been completed before and after the individual's migration to Germany. We use potential labor market experience defined as current age minus years of schooling minus 6.

Appendix-Tables A2 and A3 present key descriptive statistics for the samples of males and females, respectively. Immigrants of the pre-1974 cohort represent the largest proportion (almost 50 %) of all immigrants in the sample. Immigrants belonging to the regime of family re-unification and of the cohort after the fall of the iron curtain make up equal shares. In general, while Natives acquired around 12.2 years of education in Germany, immigrants acquired on average roughly one year less. Exceptions are immigrants from Turkey (10.2 years of total education) and the heterogeneous group of *Others* with 12.6 years of overall education. Thereby, the largest part of overall education was acquired abroad (8.8 years). Around 2.2 years of education in Germany add to the total education received for migrants. Immigrants from Turkey again differ in this respect: They have a lower fraction of education acquired in Turkey as they immigrated to Germany on average at a younger age. The

mean immigrant is 20.9 years old at the time of arrival, whereby Turkish immigrants are almost two years younger at the time of arrival. In contrast, migrants from Eastern Europe and the Ex-Yugoslavia are older at the time of immigration and thus acquired a higher proportion of education in their home country. For males, total experience differs for Germans (23 years) and migrants (25 years), which is accompanied by the fact that immigrants are slightly older than natives and, as already mentioned, received less education. Around a fourth of the total labor market experience of the immigrants was acquired abroad. Again, immigrants from Eastern Europe spent a longer time abroad and thus gained a bigger proportion of their experience abroad (more than one third). The same compositional pattern arises for women.

3 General Results

Table 1- Panel A shows the pooled OLS estimation results for the full sample of males and females respectively. Columns (1) and (4) depict the results of estimating equation (1). As expected, schooling and labor market experience affect wages positively. An additional year of schooling is associated with a wage increase of about 8% for both males and females, while an additional year of potential labor market experience is associated with a 1% wage increase for males and 1.1% wage increase for females. Male immigrants earn about 23.1% and female immigrants about 16.5% less than their native counterparts upon arrival in Germany. This initial wage disadvantage diminishes, albeit modestly, as male (female) immigrants' relative wages on average increase by 0.4% (0.2%) each year after migration.

Columns (2) and (5) of Table 1- Panel A decompose the total education of immigrants into education prior- and post-migration, and similarly for experience. The results indicate that the equality of returns to foreign and domestic-source human capital can be rejected for males. An additional year of schooling in Germany

increases their wage by 8.2%, while each year of schooling obtained in the home country yields 7.2%. For female immigrants, however, the returns to schooling abroad and in Germany are not significantly different from each other. The returns to labor market experience abroad, however, are significantly lower than the returns to labor market experience in Germany for both males and females. Experience in the home country is not rewarded at all for females.

The results for the fully unrestricted model (2) are reported in columns (3) and (6) of Table 1- Panel A. They suggest that the implicit restrictions on the returns to human capital for natives and immigrants of equation (1) could be rejected for males. The marginal returns to a year of schooling and labor market experience acquired in Germany are significantly higher than the marginal returns to human capital obtained in the home country. The returns to labor market experience obtained prior to immigration are not statistically significant at all. Overall, these results are in accordance with the existing evidence for the US and Canada (Kossoudji, 1989; Schaafsma & Sweetman, 2001).

The results also show that male immigrants yield lower returns to education undertaken in Germany, with a 2 percentage point discount over natives. As indicated by Friedberg (2000), this may be explained by the inadequacy of immigrants' country-specific skills, including a relatively weak command of the German language, which prevents them from extracting full productive benefits from each year of schooling. In contrast, there are no differences in the returns to labor market experience accumulated in Germany between natives and immigrants, which suggests that immigrants can improve their German language proficiency and acquire more information about domestic institutions and work standards, among others. Note that after controlling for the differences in the returns to foreign and domestic human capital, the initial 23.1% native-immigrant wage gap found for men not only vanishes. It also turns positive and statistically significant, which indicates a positive selection of migrants. Results presented in column (6) of Table 1 - Panel

A for females are in the same vein, except that female immigrants gain slightly less (0.3 percentage points) than their native counterparts from one year of experience in Germany. However, this effect is statistically significant only at the 10% level.

In order to account for potential differences between immigrant cohorts, we add cohort-dummies to the model. Further, we allow labor market experience as well as year since migration to have a non-linear effect by including the respective squared terms. Overall, the results of this specification confirm those shown in Table 1 (see Table 1 - Panel B). However, three important differences appear. First of all, due to the inclusion of cohort dummies, the returns to years since migration got insignificant. Second, we can reject the equality of returns to foreign and domestic human capital for both gender. Third, the previous findings that immigrants gain less than natives from one year of education in Germany are confirmed. In addition to this, the results indicate that immigrants gain less from one year of experience in Germany. [4]

Overall, the estimation results reported in both Panels of Table 1 are consistent with the view of imperfect transferability of human capital across different labor markets. They further show that allowing for imperfect transferability of human capital appears to be able to explain the immigrant-native wage gap at the time of arrival. The results finally clearly indicate that the standard model used in the literature on the wage assimilation of immigrants is misspecified.

Further, the results do not change for various robustness checks. First of all, we relaxed the assumption of a common start schooling age of 6 years. UIS (2010) offers data on the respective country specific starting ages. Allowing for country-specific starting age leads to almost identical estimation results, which is not surprising as the age of 6 is the most common age to start compulsory school overall. Second, using a Heckman-selection procedure to account for the selective labor supply decision of

[4]Even though the interaction of the immigrant dummy and experience in Germany and it's squared are statistically significant (they are also jointly significant (not reported in the table)), we do not highlight these results as the respective turning points are far below one year.

females does not change the estimation results relative to those shown in Table 1. Thirdly, we re-estimated specification 1 and 2 of Table 1 for immigrants and natives separately so that the coefficients are free to differ for both groups. Also in this respect, results did not change.[5]

4 Heterogeneity in the Returns to Human Capital

4.1 Region of Origin

While the above analysis permits the distinction between domestic and foreign human capital, it assumes that foreign human capital across different immigrant groups is rewarded homogenously. Foreign human capital, however, could be valued differently in the German labor market depending on the quality of education or work training in the source country and the transferability of these qualifications. Transferability, in turn, depends on how closely the country of origin compares to Germany in terms of economic conditions, educational systems, industrial structure, institutional settings, language, etc. For instance, developed countries are able to devote more resources to their educational systems and, hence, are more likely to have a higher general quality of education. Similarly, developed countries would use more advanced machineries and complex processes that enhance human capital accumulation faster for each year of labor market experience. In this sense, human capital acquired in developed countries is expected to have a higher degree of substitutability with human capital obtained in Germany. To allow for the returns to education and experience to vary across immigrant groups, we estimate equation (2) separately for immigrants from different regions.

The results for males and females are shown in Table 2 Panel A and Panel B[6].

[5]The results are available upon request from the authors.

[6]Results including cohort dummies (which are likely to correlate strongly with the region of

The estimates for male immigrants, taken as a whole, confirm the findings reported in Table 1. Education obtained in Germany receives higher returns than foreign education, and the returns to labor market experience in Germany are higher than the returns to foreign labor market experience. We, nevertheless, find evidence for heterogeneity across regions of origin. With respect to education, we can differentiate between three different cases. First, for OECD migrants, returns to education abroad are higher than for education gained in Germany. However, we cannot reject the hypothesis on the equality of the returns. Second, the returns to foreign and domestic education are statistically different for immigrants from Turkey and the group of *Others*, whereby education obtained in the home countries is associated with smaller returns than education obtained in Germany. Third, immigrants from Eastern Europe and Ex-Yugoslavia yield slightly smaller or all most the same returns to edcuation acquired in Germany and abroad. Again, the equality between the returns to education from both sources cannot be rejected. These results are in line with the argumentation that first, education is valued differently according to the quality of the education system, where it was acquired and second, that the transferability depends on how close the respective educational system is to the German one. Given the general pattern of rankings on the quality of educational systems (for instance UNESCO (2010)) Germany is grouped as one of the leading countries, whereby other OECD countries are on top of those ranking. Countries, as Eastern European countries, are quite comparable in their performance compared to the German case (all of them are classified as "High EDI countries"), whereby Turkey (classified as "Medium EDI country") shows a remarkable gap.

Figure 1 illustrates these findings, which are based on the parameter estimates of Table 2 - Panel B (Males). Figure 1 shows the earning development of the respective group with labor market experience in Germany. Each group is assumed to have 12 years of total education and no foreign labor market experience. However, the sim-

origin in Germany), which are available upon request from the authors, yield similar results.

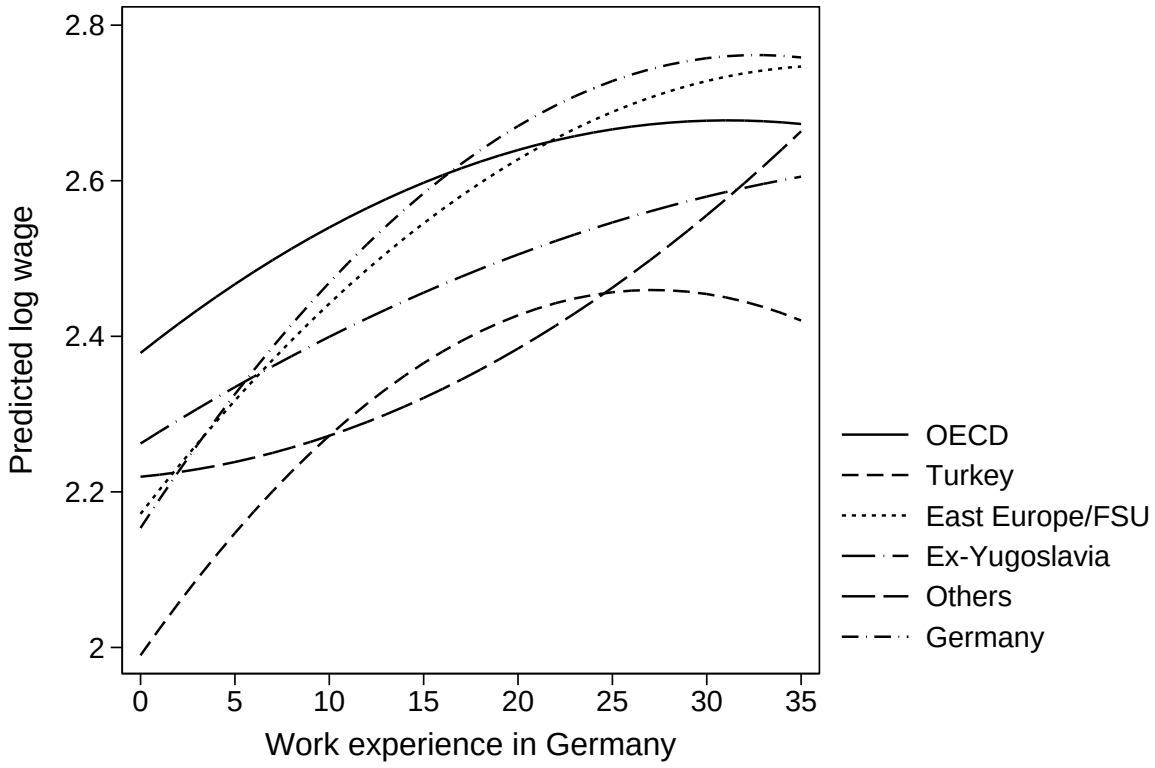

Fig. 1 Simulated assimilation profiles by area of origin (Males). It is assumed that natives obtained their education solely in Germany ($FYOS$=0, $GYOS$=12) and immigrants solely abroad ($FYOS$=12, $GYOS$=12). Further, immigrants have no foreign labor market experience (FLX=0).

ulations assume that native males acquired all their education in Germany ($FYOS$ = 0, $GYOS$ =12), whereby immigrants obtained their education in their country of origin ($FYOS$ = 12, $GYOS$ =0). Initially, immigrants from high-income OECD countries gain the most from their education acquired abroad. However, Germans catch-up and overtake them soon. For immigrants from Eastern Europe/fSU and Ex-Yugoslavia wages are in general lower, but at least immigrants from Eastern Europe/fSU face a rapid increase in wages. The group of *Others* and immigrants from Turkey are lagging far behind.

For males, only labor market experience accumulated in high-income OECD generates significant positive returns in Germany in both specifications (Table 2, Panel

A and B), while foreign experience obtained elsewhere appears not to be valued at all. This result is quite intuitive. On average, we expect the industrial structures and technology to be comparable between Germany and high-income OECD countries. Hence, work experience accumulated in these countries is more easily transferable to the German labor market than labor market experience obtained in other regions. Immigrants from Turkey, East Europe/fSU, and ex-Yugoslavian countries earn about 0.9-1.5% (Table 2 - Panel A) in wage increment with every year spent in the German labor market. The returns to foreign and domestic experience of these immigrants differ significantly.

For females, we find that the returns to German education do not statistically differ at conventional significance levels from the returns to education acquired abroad, irrespectively of the region of origin. Similar to what we found for males, only the foreign labor market experience of immigrants from high-income OECD receive positive returns in the German labor market (Table 2 - Panel A). All others obtain zero returns.

4.2 Immigration Cohort

Table 3 (Panel A and B) shows the results of estimating equation (2) separately by cohort of arrival. Among male immigrants, those who arrived in Germany in the period 1974-1988 receive slightly higher returns to foreign education than the other immigration cohorts. This group gains also the most from one year of education in Germany. However, for none of the groups the difference between the returns to education obtained in the host and the home country is statistically significant. Again, for labor market experience acquired in the home countries this is the opposite, i.e. we can reject the null hypothesis on equal returns. In addition, labor market experience acquired at home is not rewarded at all. In both Panels, immigrants who arrived during the guest-worker regime, yield the lowest return to experience in Germany. For females, we find that education markedly influences the wages of

the earliest wave of migrants, while in general foreign labor market experience does not appear to translate significantly to an increase in earnings. Overall, it is again only German work experience that matters.

4.3 Temporary vs. Permanent Migrants

We next make a distinction between temporary and permanent immigrants. For our purpose, we classify immigrants as temporary if they claimed that they do not wish to stay in Germany permanently over the three years preceding the respective survey year. Temporary migrants might have weaker incentives to accumulate new skills and rely more on the human capital they have brought with them upon migration, while permanent migrants have more incentives to invest in skills suited to the German labor market, since they will have a longer time horizon to extract benefits from this investment. In this respect, the skill components of these two groups might differ.

Table 4 (Panel A and B) reports the results of estimating an extended version of equation (2), in which we included interaction variables between the different human capital indicators and a dummy variable, that takes the value 1 for temporary migrants. Temporary migrants earn about 52% less than permanent migrants. Their respective returns to human capital acquired in Germany do not differ significantly from those of permanent migrants. However, we find that education and experience of temporary migrants obtained abroad yield slightly higher returns (by 3.0 and 1.3 percentage points, respectively). The estimation results may be explained by a selection of permanent and temporary migrants into different jobs with the latter selecting themselves predominantly into low-paid jobs that offer relatively high returns to their human capital accumulated prior to migration and without requiring them to invest in host country-specific human capital. For females, we find no significant differences between permanent and temporary migrants. Furthermore, the results are consistent with our previous findings: Domestically obtained human

capital is valued higher than foreign human capital and, in most of the cases, the differences are statistically significant.

4.4 Complementarity of Human Capital

Upon arrival, immigrants may be constrained in their job opportunities and forced to take up low-paying jobs that do not require local-specific skills. Thus, they may not be able to extract the full benefits for the qualifications they have previously obtained in their home countries. However, over time, as they gain these country-specific skills – by e.g. attending school in Germany or on-the-job training – they may be able to find better-paying jobs to which they will be able to apply their pre-migration qualifications more efficiently. Hence, potential complementarities between pre- and post-immigration human capital investments may result in the returns to the pre-migration stock of human capital to increase with human capital investments in the receiving country.

To examine whether there are such complementarities, we estimate equation (2) augmented with variables interacting foreign and domestic human capital. The results of this specification are presented in Table 5. Overall, they show that the interaction effects are statistically insignificant both for the male and female samples. If there are single statistically significant effects, they are economically small in magnitude. This suggests that the returns to foreign human capital do not vary significantly with the accumulation of human capital in Germany.

4.5 Non-linear Returns to Schooling

So far, our analyses assume linearity in the returns to schooling. That is, each year of schooling earns the same returns irrespective of whether it was at the primary, secondary, university or post-graduate level. However, if returns to schooling are decreasing over levels, then the returns to German education of immigrants may be biased downwards. To investigate this potential bias, we split education

into three levels, namely: Primary (years 1-9), Secondary (10-13) and University or post-secondary (14 and above). To investigate the returns to education at different schooling levels, we estimate a piecewise linear function using the mentioned educational levels as knots, i.e. we estimate the model:

$$\begin{aligned} w_{i,t} &= \gamma_0 + \gamma_1 I_i + \gamma_2 S^f_{i,t} + \gamma_3[(S^f_{i,t} - S(9)) * d_9] + \gamma_4[(S^f_{i,t} - S(13)) * d_{13}] + \\ &+ \gamma_5 S^d_{i,t} + \gamma_6[(S^d_{i,t} - S(9)) * d_9] + \gamma_7[(S^d_{i,t} - S(13)) * d_{13}] + \\ &+ \gamma_8 EXP^f_{i,t} + \gamma_9 EXP^d_{i,t} + \gamma'_{10} X_{i,t} + \varepsilon_{i,t}, \end{aligned} \tag{3}$$

where $S(9)$ and $S(13)$ are structural breaks at 9 and 13 years of schooling, respectively, and d_9 and d_{13} are the respective break dummies.

Table 6 - were we again allowed experience to have a non-linear form[7]- shows that there are indeed non-linearities in the returns to education. For natives, primary education does not generate significant returns, while an additional year of secondary education increases wages by 10.3% (10.6%) for males (females) and university education by 7.3% (6.9%). For immigrants, university education has the highest returns. In general, primary education is equally valued regardless of where it was obtained. The exceptions to this finding are on the one hand immigrants from Turkey and from the group of *Others*, whose returns to primary education abroad are lower than those obtained in Germany, while immigrants from Eastern Europe/fSU gain more from primary education acquired at home. Concerning secondary education, migrants as a whole and especially immigrants from Turkey and Ex-Yugoslavia receive higher returns to education acquired in Germany. University education obtained abroad generates lower returns than university education obtained in Germany. This could indicate that the skills incorporated at low levels of education are quite transferable across different labor markets. However, this portability decreases with higher schooling levels.

[7]Results including cohort dummies, which are available upon request from the authors, yield the same results.

5 Conclusion

This paper examines whether the returns to human capital differ for natives and immigrants, and whether they depend on where the qualifications were acquired. Human capital obtained from the origin country may not be equivalent to those obtained in the host country due to limited transferability of skills and imperfect compatibility of home and host country labor markets. The returns to domestic human capital may differ for natives and immigrants depending on who derives compound benefits from each year of human capital. For instance, immigrants may yield higher returns to German labor market experience because each year of work experience does not only allow them to gain occupational skills but also gain language proficiency and local knowledge.

We find that, for immigrants taken as a whole, foreign schooling is valued lower in the German labor market than domestic schooling. Remarkably, foreign labor market experience yields virtually zero returns. The returns to schooling obtained in Germany also appear to be lower for immigrants if compared to natives, at least for the males. Our results further indicate that the wage differential between natives and immigrants can be explained by the lower value attached to immigrants' foreign human capital.

We, nevertheless, find evidence for heterogeneity across immigrant groups. In particular, immigrants from high-income countries tend to earn higher returns to their foreign human capital than the other groups. This lends support to the importance of compatibility of the immigrants' home and host countries for the transferability of human capital.

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Tables

Table 1 - Panel A:
Returns to Human Capital: Foreign versus Domestically-acquired Skills

	Males			Females		
	(1)	(2)	(3)	(4)	(5)	(6)
Immigrant (I)	-0.231***	-0.003	0.178**	-0.165***	-0.009	0.214**
	(0.023)	(0.027)	(0.072)	(0.035)	(0.030)	(0.094)
Education	0.082***	–	–	0.084***	–	–
	(0.002)			(0.003)		
Education abroad	–	0.072***	0.059***	–	0.077***	0.066***
		(0.004)	(0.006)		(0.005)	(0.007)
Education in Germany	–	0.082***	0.084***	–	0.083***	0.084***
		(0.002)	(0.002)		(0.003)	(0.003)
Total Experience	0.010***	–	–	0.011***	–	–
	(0.000)			(0.000)		
Experience abroad/100	–	0.312**	0.131	–	0.194	-0.079
		(0.122)	(0.133)		(0.164)	(0.170)
Experience in Germany	–	0.010***	0.010***	–	0.011***	0.012***
		(0.000)	(0.000)		(0.000)	(0.001)
Years since Migration	0.004***	–	–	0.002*	–	–
	(0.001)			(0.001)		
Education Germany x (I)	–	–	-0.020***	–	–	-0.017**
			(0.006)			(0.007)
Experience Germany x (I)	–	–	0.001	–	–	-0.003*
			(0.001)			(0.001)
Constant	0.982***	0.963***	0.936***	0.727***	0.736***	0.710***
	(0.024)	(0.023)	(0.024)	(0.039)	(0.039)	(0.041)
R-squared	0.496	0.497	0.498	0.503	0.503	0.504
Observations	73399	73470	73470	33225	33250	33250
Tests (p-value):						
$\gamma\_FYOS = \gamma\_GYOS$		0.002	0.000		0.111	0.017
$\gamma\_FLX = \gamma\_GLX$		0.000	0.000		0.000	0.000

Notes: * (**, ***) Significant at 10% (5%, 1%). Weighted OLS using weights provided by the SOEP. Standard errors, which are reported in parentheses, are adjusted in order to take repeated observations on the same worker into account. The regression further includes information on the individual's marital status and number of children, and dummies for state of residence, industry of employment and year of observation. *FYOS* and *FLX*, respectively, refer to education and labor market experience obtained in the home country, while *GYOS* and *GLX* refer to education and labor market experience accumulated in Germany. Tests are adjusted for the re-scaling of variable Experience abroad/100.

Table 1 - Panel B:

Returns to Human Capital: Foreign versus Domestically-acquired Skills

	Males			Females		
	(1)	(2)	(3)	(4)	(5)	(6)
Immigrant (I)	-0.268***	0.016	0.330***	-0.233***	0.039	0.322***
	(0.037)	(0.036)	(0.083)	(0.071)	(0.045)	(0.107)
(I) x Pre 1974	0.085**	-0.022	0.044	0.073*	-0.059	0.047
	(0.033)	(0.027)	(0.033)	(0.042)	(0.038)	(0.043)
(I) x Cohort 1974 to 1988	0.063**	-0.016	0.013	0.038	-0.050	0.012
	(0.029)	(0.026)	(0.028)	(0.035)	(0.036)	(0.036)
Education	0.081***	–	–	0.082***	–	–
	(0.002)			(0.003)		
Education abroad	–	0.072***	0.061***	–	0.074***	0.066***
		(0.004)	(0.006)		(0.005)	(0.008)
Education in Germany	–	0.082***	0.084***	–	0.081***	0.083***
		(0.002)	(0.002)		(0.003)	(0.003)
Total Experience	0.035***	–	–	0.039***	–	–
	(0.001)			(0.002)		
Total Experiences	-0.001***	–	–	-0.001***	–	–
	(0.000)			(0.000)		
Experience abroad/100	–	0.212	-0.313	–	0.118	-0.199
		(0.360)	(0.398)		(0.515)	(0.544)
Experience abroad^2/100	–	0.000	0.012	–	-0.005	-0.001
		(0.014)	(0.015)		(0.021)	(0.022)
Experience in Germany	–	0.036***	0.038***	–	0.040***	0.042***
		(0.001)	(0.002)		(0.002)	(0.002)
Experience in Germany^2/100	–	-0.055***	-0.058***	–	-0.067***	-0.069***
		(0.003)	(0.003)		(0.004)	(0.004)
Years since Migration	0.006	–	–	0.007	–	–
	(0.004)			(0.006)		
Years since Migration^2/100	-0.007	–	–	-0.011	–	–
	(0.009)			(0.012)		
Education Germany x (I)	–	–	-0.021***	–	–	-0.017**
			(0.006)			(0.007)
Experience Germany x (I)	–	–	-0.013***	–	–	-0.017***
			(0.004)			(0.006)
Experience in Germany^2/100 * (I)	–	–	2.019**	–	–	2.532**
			(1.009)			(1.216)
Constant	0.777***	0.767***	0.720***	0.561***	0.568***	0.534***
	(0.025)	(0.025)	(0.026)	(0.040)	(0.041)	(0.042)
R-squared	0.516	0.517	0.518	0.531	0.531	0.533
Observations	73399	73470	73470	33225	33250	33250
$\gamma\_FYOS = \gamma\_GYOS$		0.006	0.000		0.073	0.040
$\gamma\_FLX = \gamma\_GLX$		0.000	0.000		0.000	0.000

Notes: * (**, ***) Significant at 10% (5%, 1%). See for further notes Table 1 - Panel A.

Table 2: Returns to Human Capital, by Region of Origin

	Panel A - MALES						
		All			East Europe/	Ex-	
	Natives	Immigrants	OECD	Turkey	fSU	Yugoslavia	Others
Education abroad	–	0.060***	0.071***	0.027***	0.053***	0.034***	0.042***
		(0.006)	(0.010)	(0.009)	(0.008)	(0.007)	(0.013)
Education in Germany	0.084***	0.064***	0.066***	0.041***	0.058***	0.034***	0.081***
	(0.002)	(0.006)	(0.010)	(0.010)	(0.009)	(0.009)	(0.014)
Experience abroad/100	–	0.012	0.771***	-0.259	-0.277*	-0.877***	1.276**
		(0.130)	(0.196)	(0.207)	(0.148)	(0.228)	(0.497)
Experience in Germany	0.010***	0.011***	0.006***	0.011***	0.015***	0.009***	0.013***
	(0.000)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.005)
R-squared	0.507	0.407	0.536	0.473	0.433	0.437	0.546
Observations	57928	15542	5330	4468	2832	2512	400
$\gamma\_FYOS = \gamma\_GYOS$		0.117	0.332	0.000	0.238	0.922	0.000
$\gamma\_FLX = \gamma\_GLX$		0.000	0.480	0.000	0.000	0.000	1.000

	Panel B - MALES						
		All			East Europe/	Ex-	
	Natives	Immigrants	OECD	Turkey	fSU	Yugoslavia	Others
Education abroad	–	0.059***	0.071***	0.026***	0.051***	0.035***	0.042***
		(0.006)	(0.011)	(0.008)	(0.008)	(0.007)	(0.013)
Education in Germany	0.084***	0.063***	0.068***	0.038***	0.060***	0.035***	0.079***
	(0.002)	(0.006)	(0.012)	(0.009)	(0.009)	(0.010)	(0.015)
Experience abroad/100	–	-0.298	1.310*	-0.936*	0.283	-0.510	0.273
		(0.356)	(0.786)	(0.503)	(0.450)	(0.633)	(1.840)
Experience abroad^2 /100	–	0.009	-0.027	0.030	-0.022	-0.017	0.046
		(0.014)	(0.030)	(0.022)	(0.014)	(0.024)	(0.078)
Experience in Germany	0.037***	0.028***	0.019***	0.035***	0.031***	0.015**	0.002
	(0.002)	(0.004)	(0.007)	(0.006)	(0.006)	(0.007)	(0.013)
Experience in Germany^2 /100	-0.057***	-0.041***	-0.031**	-0.064***	-0.042***	-0.016	0.030
	(0.003)	(0.009)	(0.015)	(0.017)	(0.015)	(0.015)	(0.036)
R-squared	0.528	0.415	0.542	0.485	0.445	0.439	0.551
Observations	57928	15542	5330	4468	2832	2512	400
$\gamma\_FYOS = \gamma\_GYOS$		0.299	0.479	0.006	0.102	0.964	0.000
$\gamma\_FLX = \gamma\_GLX$		0.000	0.556	0.000	0.000	0.033	0.984

Notes: * (**, ***) Significant at 10% (5%, 1%). The OECD category excludes Turkey and other non-high income member nations while East Europe excludes countries from former Yugoslavia. See further notes in Table 1 - Panel A.

Table 2 continued: Returns to Human Capital, by Region of Origin

	Panel A - FEMALES						
	Natives	All Immigrants	OECD	Turkey	East Europe/ fSU	Ex-Yugoslavia	Others
Education abroad	–	0.065***	0.099***	0.052***	0.045***	0.073***	0.052***
		(0.008)	(0.010)	(0.015)	(0.011)	(0.014)	(0.018)
Education in Germany	0.085***	0.066***	0.100***	0.053***	0.051***	0.069***	0.055***
	(0.003)	(0.007)	(0.012)	(0.013)	(0.012)	(0.015)	(0.020)
Experience abroad/100	–	-0.065	0.684***	-0.165	-0.253	0.432	0.336
		(0.174)	(0.248)	(0.301)	(0.311)	(0.315)	(0.511)
Experience in Germany	0.011***	0.010***	0.013***	0.011***	0.013***	0.007**	0.006*
	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)
R-squared	0.511	0.440	0.638	0.585	0.357	0.497	0.666
Observations	26816	6434	2151	1191	1484	1444	164
$\gamma\_FYOS = \gamma\_GYOS$		0.660	0.911	0.879	0.318	0.778	0.713
$\gamma\_FLX = \gamma\_GLX$		0.000	0.041	0.024	0.000	0.446	0.523

	Panel B - FEMALES						
	Natives	All Immigrants	OECD	Turkey	East Europe/ fSU	Ex-Yugoslavia	Others
Education abroad	–	0.064***	0.098***	0.049***	0.041***	0.073***	0.045**
		(0.008)	(0.010)	(0.016)	(0.012)	(0.014)	(0.018)
Education in Germany	0.083***	0.065***	0.098***	0.051***	0.049***	0.064***	0.043**
	(0.003)	(0.008)	(0.011)	(0.014)	(0.013)	(0.016)	(0.019)
Experience abroad/100	–	-0.039	0.221	0.775	0.298	-0.386	-4.224**
		(0.540)	(0.697)	(0.912)	(0.952)	(0.870)	(1.962)
Experience abroad^2 /100	–	-0.005	0.011	-0.053	-0.026	0.030	0.178**
		(0.021)	(0.027)	(0.037)	(0.033)	(0.030)	(0.076)
Experience in Germany	0.042***	0.023***	0.031***	0.024***	0.034***	0.029***	0.014
	(0.002)	(0.005)	(0.007)	(0.008)	(0.011)	(0.009)	(0.015)
Experience in Germany^2 /100	-0.070***	-0.034***	-0.047***	-0.039*	-0.057**	-0.053***	-0.018
	(0.004)	(0.011)	(0.015)	(0.021)	(0.028)	(0.019)	(0.038)
R-squared	0.542	0.446	0.648	0.591	0.371	0.509	0.685
Observations	26816	6434	2151	1191	1484	1444	164
$\gamma\_FYOS = \gamma\_GYOS$		0.691	0.981	0.776	0.216	0.488	0.734
$\gamma\_FLX = \gamma\_GLX$		0.002	0.005	0.227	0.057	0.011	0.065

Notes: * (**, ***) Significant at 10% (5%, 1%). The OECD category excludes Turkey and other non-high income member nations while East Europe excludes countries from former Yugoslavia. See further notes in Table 1 - Panel A.

Table 3:

Returns to Human Capital, by Immigration Cohort

	Panel A - MALES			
	All Immigrants	Pre-1974	1974-1988	1989-2011
Education abroad	0.0575***	0.0475***	0.0583***	0.0518***
	(0.0061)	(0.0106)	(0.0064)	(0.0084)
Education in Germany	0.0622***	0.0566***	0.0595***	0.0543***
	(0.0056)	(0.0090)	(0.0090)	(0.0112)
Experience abroad/100	-0.0017	-0.0864	-0.1247	-0.2393
	(0.1326)	(0.1730)	(0.2249)	(0.1667)
Experience in Germany	0.0107***	0.0095***	0.0157***	0.0184***
	(0.0012)	(0.0033)	(0.0039)	(0.0044)
R-squared	0.413	0.524	0.449	0.378
Observations	15542	8783	3866	2893
$\gamma\_FYOS = \gamma\_GYOS$	0.123	0.118	0.852	0.750
$\gamma\_FLX = \gamma\_GLX$	0.000	0.006	0.000	0.000

	Panel B - MALES			
	All Immigrants	Pre-1974	1974-1988	1989-2011
Education abroad	0.0568***	0.0477***	0.0584***	0.0516***
	(0.0060)	(0.0105)	(0.0064)	(0.0085)
Education in Germany	0.0605***	0.0562***	0.0600***	0.0546***
	(0.0058)	(0.0090)	(0.0098)	(0.0115)
Experience abroad/100	-0.2072	-0.5231	0.3375	-0.0042
	(0.3470)	(0.6366)	(0.6094)	(0.5237)
Experience abroad ^{2} /100	0.0045	0.0179	-0.0255	-0.0089
	(0.0137)	(0.0282)	(0.0200)	(0.0179)
Experience in Germany	0.0285***	0.0214***	0.0514***	0.0249*
	(0.0037)	(0.0059)	(0.0086)	(0.0135)
Experience in Germany ^{2} /100	-0.0451***	-0.0246*	-0.1033***	-0.0281
	(0.0095)	(0.0138)	(0.0223)	(0.0543)
R-squared	0.423	0.526	0.467	0.379
Observations	15542	8783	3866	2893
$\gamma\_FYOS = \gamma\_GYOS$	0.257	0.151	0.819	0.722
$\gamma\_FLX = \gamma\_GLX$	0.000	0.005	0.000	0.083

Notes: * (**, ***) Significant at 10% (5%, 1%). See further notes in Table 1 - Panel A. Besides the control variables listed in the preceding tables, here region of origin dummies are included additionally (Group *Others* as reference.)

Table 3 continued:
Returns to Human Capital, by Immigration Cohort

	Panel A - FEMALES			
	All Immigrants	Pre-1974	1974-1988	1989-2011
Education abroad	0.0636***	0.0848***	0.0575***	0.0242*
	(0.0077)	(0.0120)	(0.0111)	(0.0139)
Education in Germany	0.0661***	0.0799***	0.0419***	0.0404***
	(0.0075)	(0.0122)	(0.0148)	(0.0129)
Experience abroad/100	-0.0565	0.3848*	0.1830	-0.9281***
	(0.1742)	(0.2246)	(0.2637)	(0.3399)
Experience in Germany	0.0098***	0.0037	-0.0002	0.0268***
	(0.0015)	(0.0042)	(0.0054)	(0.0074)
R-squared	0.445	0.580	0.590	0.289
Observations	6434	3593	1804	1037
$\gamma\_FYOS = \gamma\_GYOS$	0.524	0.506	0.022	0.068
$\gamma\_FLX = \gamma\_GLX$	0.000	0.978	0.679	0.000

	Panel B - FEMALES			
	All Immigrants	Pre-1974	1974-1988	1989-2011
Education abroad	0.0621***	0.0837***	0.0557***	0.0235*
	(0.0078)	(0.0121)	(0.0115)	(0.0137)
Education in Germany	0.0646***	0.0780***	0.0425***	0.0375***
	(0.0078)	(0.0121)	(0.0159)	(0.0137)
Experience abroad/100	-0.0468	-0.0520	0.9872	-1.2694
	(0.5285)	(0.7631)	(0.6980)	(1.0052)
Experience abroad ^{2} /100	-0.0051	0.0182	-0.0342	0.0108
	(0.0207)	(0.0338)	(0.0241)	(0.0355)
Experience in Germany	0.0243***	0.0138	0.0212**	0.0367**
	(0.0048)	(0.0085)	(0.0106)	(0.0152)
Experience in Germany ^{2} /100	-0.0378***	-0.0226	-0.0613***	-0.0437
	(0.0110)	(0.0151)	(0.0208)	(0.0686)
R-squared	0.452	0.582	0.599	0.290
Observations	6434	3593	1804	1037
$\gamma\_FYOS = \gamma\_GYOS$	0.548	0.452	0.074	0.152
$\gamma\_FLX = \gamma\_GLX$	0.001	0.229	0.325	0.009

Notes: * (**, ***) Significant at 10% (5%, 1%). See further notes in Table 1 - Panel A. Besides the control variables listed in the preceding tables, here region of origin dummies are included additionally (Group *Others* as reference.)

Table 4:

Returns to Human Capital: Foreign versus Domestically-acquired Skills, Permanent and Temporary Immigrants

	All	Males	Females	All	Males	Females
Education abroad	0.058***	0.044***	0.072***	0.058***	0.044***	0.071***
	(0.006)	(0.007)	(0.009)	(0.006)	(0.007)	(0.010)
Education in Germany	0.064***	0.052***	0.072***	0.063***	0.051***	0.074***
	(0.005)	(0.007)	(0.009)	(0.005)	(0.007)	(0.009)
Experience abroad/100	-0.014	-0.199	-0.029	-0.247	-0.534	0.458
	(0.128)	(0.146)	(0.212)	(0.340)	(0.377)	(0.571)
Experience abroad ^{2} /100	–	–	–	0.006	0.010	-0.024
	–	–	–	(0.014)	(0.015)	(0.025)
Experience in Germany	0.010***	0.011***	0.007***	0.025***	0.026***	0.026***
	(0.001)	(0.001)	(0.002)	(0.004)	(0.004)	(0.005)
Experience in Germany ^{2} /100	–	–	–	-0.040***	-0.039***	-0.050***
	–	–	–	(0.009)	(0.010)	(0.012)
Immigrant, Temp	-0.520*	-0.548*	0.256	-0.803**	-0.907**	0.063
	(0.300)	(0.317)	(0.362)	(0.363)	(0.419)	(0.391)
Educ abroad, Temp	0.040**	0.048**	-0.012	0.036**	0.050***	-0.014
	(0.019)	(0.021)	(0.026)	(0.016)	(0.018)	(0.024)
Educ Germany, Temp	0.007	0.006	-0.038	0.008	0.006	-0.042
	(0.029)	(0.030)	(0.027)	(0.027)	(0.028)	(0.026)
Exp abroad, Temp	0.013**	0.016**	-0.002	0.025	0.011	0.001
	(0.006)	(0.007)	(0.006)	(0.016)	(0.020)	(0.019)
Experience abroad ^{2}, Temp	–	–	–	-0.057	0.009	-0.006
	–	–	–	(0.060)	(0.078)	(0.074)
Exp Germany, Temp/100	0.650	0.500	-0.480	3.220	3.744	1.293
	(0.595)	(0.693)	(0.564)	(2.192)	(2.589)	(2.191)
Exp Germany ^{2}, Temp/ 100	–	–	–	-4.711	-5.988	-3.121
	–	–	–	(3.949)	(4.643)	(4.126)
R-squared	0.442	0.445	0.525	0.451	0.455	0.540
Observations	15360	10897	4463	15360	10897	4463
$\gamma\_FYOS = \gamma\_GYOS$	0.015	0.011	0.830	0.047	0.050	0.542
$\gamma\_FLX = \gamma\_GLX$	0.000	0.000	0.006	0.000	0.000	0.009

Notes: * (**, ***) Significant at 10% (5%, 1%). See further notes in Table 1 - Panel A.
Temporary migrants are defined as immigrants who do not wish to stay permanently in Germany in the last three years from the survey year. Besides the control variables listed in the preceding tables, here region of origin dummies are included additionally (Group *Others* as reference.)

Table 5:

Complementarity of Foreign and Domestic Human Capital by Region of Origin

	MALES					
	All Immigrants	OECD	Turkey	East Europe fSU	Ex-Yugoslavia	Others
(I) x Cohort Pre- 1974	-0.02899	-0.07303	-0.07034	-0.13824	0.20334*	-0.11801
	(0.05927)	(0.11896)	(0.09232)	(0.10904)	(0.11731)	(0.18314)
(I) x Cohort 1974 to 1988	-0.01973	-0.09379	-0.07823	-0.05331	0.21999***	-0.19309*
	(0.03757)	(0.08025)	(0.07084)	(0.04620)	(0.07637)	(0.10780)
Education abroad	0.05274***	0.07392***	0.02164**	0.03894***	0.02415**	0.03113**
	(0.00678)	(0.01018)	(0.01084)	(0.00935)	(0.01052)	(0.01227)
Education in Germany	0.06126***	0.06820***	0.03652***	0.06044***	0.02646**	0.07247***
	(0.00647)	(0.01147)	(0.00992)	(0.01006)	(0.01158)	(0.01953)
Experience abroad/100	1.25565***	1.52349	0.73961	2.22637***	1.85196**	1.69649
	(0.47485)	(1.23496)	(0.75541)	(0.54472)	(0.90805)	(2.06740)
Experience abroad ^{2}/100	-0.02078	-0.03883	0.01339	-0.05217***	-0.05911**	0.03887
	(0.01419)	(0.03541)	(0.02441)	(0.01360)	(0.02607)	(0.07552)
Experience in Germany	0.03151***	0.02379***	0.04025***	0.04015***	0.00496	0.01155
	(0.00482)	(0.00725)	(0.00769)	(0.00907)	(0.00804)	(0.01495)
Experience in Germany ^{2}/100	-0.04722***	-0.03574**	-0.06298***	-0.05984***	-0.01643	0.00527
	(0.00963)	(0.01577)	(0.01635)	(0.01750)	(0.01407)	(0.03040)
Educ abroad x Educ Germany	0.00194**	0.00055	0.00162	0.00166	0.00358**	0.00342
	(0.00093)	(0.00215)	(0.00133)	(0.00164)	(0.00177)	(0.00219)
Educ abroad x Exp Germany	0.00019	-0.00015	-0.00007	0.00057	0.00079*	0.00047
	(0.00032)	(0.00038)	(0.00039)	(0.00037)	(0.00047)	(0.00067)
Exp abroad /100 x Exp Germany	-0.05163***	-0.00204	-0.07368***	-0.09134***	-0.07048***	-0.09768*
	(0.01549)	(0.02946)	(0.02803)	(0.02197)	(0.02402)	(0.05668)
R-squared	0.421	0.544	0.494	0.462	0.463	0.596
Observations	15542	5330	4468	2832	2512	400

Table 5 continued:

Complementarity of Foreign and Domestic Human Capital by Region of Origin

	FEMALES					
	All Immigrants	OECD	Turkey	East Europe/ fSU	Ex-Yugoslavia	Others
(I) x Cohort Pre 1974	0.02342	-0.15940	-0.03158	0.19616	-0.17141	0.44555
	(0.08328)	(0.10906)	(0.18347)	(0.14155)	(0.16716)	(0.29449)
(I) x Cohort 1974 to 1988	-0.01316	-0.10854	-0.11084	0.07458	-0.17537	0.29741***
	(0.05220)	(0.07381)	(0.16851)	(0.07826)	(0.12351)	(0.09881)
Education abroad	0.05139***	0.08692***	0.02650*	0.01061	0.05969**	0.05168**
	(0.01085)	(0.01103)	(0.01482)	(0.01930)	(0.02428)	(0.02137)
Education in Germany	0.06210***	0.09837***	0.04158***	0.03825***	0.06063***	0.02327
	(0.00850)	(0.01304)	(0.01322)	(0.01205)	(0.01950)	(0.02208)
Experience abroad/100	0.47381	0.51937	0.06780	0.03399	2.26337	-4.27714**
	(0.75315)	(1.15364)	(1.67146)	(1.02173)	(1.74358)	(2.07510)
Experience abroad ^{2}/100	-0.01501	-0.00239	-0.02527	-0.02108	-0.02461	0.17729**
	(0.02257)	(0.03176)	(0.04568)	(0.03204)	(0.04480)	(0.07798)
Experience in Germany	0.01981***	0.03331***	0.02511***	0.01460	0.04136***	0.01964
	(0.00597)	(0.00968)	(0.00893)	(0.01190)	(0.00996)	(0.01505)
Experience in Germany ^{2}/100	-0.03874***	-0.05099***	-0.07025***	-0.06172**	-0.06014**	-0.04848
	(0.01219)	(0.01496)	(0.02421)	(0.02600)	(0.02367)	(0.04420)
Educ abroad x Educ Germany	0.00120	0.00340	-0.00100	0.00004	0.00282	0.00129
	(0.00111)	(0.00228)	(0.00233)	(0.00136)	(0.00278)	(0.00465)
Educ abroad x Exp Germany	0.00059	0.00042	0.00105*	0.00169***	-0.00004	-0.00088
	(0.00040)	(0.00047)	(0.00058)	(0.00064)	(0.00079)	(0.00081)
Exp abroad /100 x Exp Germany	-0.01458	-0.00303	-0.00194	0.02161	-0.08431**	-0.02082
	(0.02032)	(0.03339)	(0.03977)	(0.03584)	(0.04164)	(0.08562)
R-squared	0.450	0.654	0.604	0.397	0.523	0.709
Observations	6434	2151	1191	1484	1444	164

Notes: * (**, ***) Significant at 10% (5%, 1%). See further notes in Table 1 - Panel A.

Table 6:
Returns to Schooling by Level and Region of Origin

	MALES						
	Natives	Immigrants	All OECD	Turkey	East Europe/ fSU	Ex-Yugoslavia	Others
Experience abroad/100	–	-0.3937	1.2030	-0.7818	0.2321	-0.4148	1.3501
	–	(0.3367)	(0.7729)	(0.5124)	(0.4288)	(0.6573)	(1.9249)
Experience abroad ^{2}/100	–	0.0091	-0.0363	0.0159	-0.0208	-0.0208	0.0078
	–	(0.0128)	(0.0303)	(0.0225)	(0.0135)	(0.0234)	(0.0837)
Experience in Germany	0.0371***	0.0271***	0.0221***	0.0336***	0.0349***	0.0121*	0.0107
	(0.0015)	(0.0036)	(0.0068)	(0.0060)	(0.0054)	(0.0065)	(0.0131)
Experience in Germany ^{2}/100	-0.0564***	-0.0416***	-0.0390***	-0.0625***	-0.0520***	-0.0081	0.0094
	(0.0030)	(0.0092)	(0.0146)	(0.0170)	(0.0139)	(0.0150)	(0.0330)
Total Primary	0.0379	0.0170	0.0242	0.0112	0.0891**	-0.0091	-0.0110
	(0.0293)	(0.0136)	(0.0195)	(0.0263)	(0.0407)	(0.0209)	(0.1297)
Total Secondary	0.1028***	0.0282**	0.0095	0.0404**	0.0288	0.0801***	0.0003
	(0.0053)	(0.0139)	(0.0292)	(0.0177)	(0.0223)	(0.0270)	(0.0723)
Total University	0.0729***	0.1151***	0.1278***	0.0611***	0.1464***	0.1012	0.1409***
	(0.0036)	(0.0129)	(0.0256)	(0.0111)	(0.0282)	(0.1422)	(0.0431)
Primary Abroad	–	-0.0029	0.0021	-0.0078*	-0.0050	0.0112	-0.0727***
		(0.0040)	(0.0083)	(0.0043)	(0.0083)	(0.0073)	(0.0211)
Secondary Abroad	–	0.0061	0.0194	-0.0264	0.0108	-0.0429	0.1014
		(0.0139)	(0.0329)	(0.0189)	(0.0225)	(0.0266)	(0.0675)
University Abroad	–	-0.0042	0.0038	-0.0359	-0.0790**	-0.0491	-0.1379**
		(0.0233)	(0.0427)	(0.0677)	(0.0321)	(0.1429)	(0.0611)
R-squared	0.529	0.442	0.566	0.486	0.484	0.452	0.616
Observations	57928	15471	5315	4457	2814	2497	388

Table 6 continued:
Returns to Schooling by Level and Region of Origin

	FEMALES						
	Natives	Immigrants	All OECD	Turkey	East Europe/ fSU	Ex-Yugoslavia	Others
Experience abroad/100	–	0.0427	-0.4523	0.9638	0.5890	-0.4141	-1.2024
	–	(0.5410)	(0.6246)	(0.7807)	(1.0024)	(0.9047)	(2.5177)
Experience abroad ^{2}/100	–	-0.0057	0.0278	-0.0567*	-0.0311	0.0304	0.0591
	–	(0.0208)	(0.0240)	(0.0332)	(0.0341)	(0.0315)	(0.0893)
Experience in Germany	0.0418***	0.0260***	0.0307***	0.0291***	0.0419***	0.0287***	0.0275*
	(0.0019)	(0.0048)	(0.0062)	(0.0071)	(0.0107)	(0.0091)	(0.0156)
Experience in Germany ^{2}/100	-0.0689***	-0.0388***	-0.0465***	-0.0472**	-0.0749***	-0.0529***	-0.0562
	(0.0042)	(0.0109)	(0.0147)	(0.0193)	(0.0271)	(0.0194)	(0.0439)
Total Primary	0.0267	0.0364**	0.0094	0.0521**	0.0276	0.0582*	0.0042
	(0.0533)	(0.0158)	(0.0221)	(0.0233)	(0.0660)	(0.0322)	(0.0879)
Total Secondary	0.1065***	0.0632***	0.0516	0.0388	0.0476*	0.0543	0.0950
	(0.0071)	(0.0161)	(0.0324)	(0.0243)	(0.0254)	(0.0415)	(0.0589)
Total University	0.0688***	0.0998***	0.1736***	0.0372	0.0802***	0.0804**	-0.0317
	(0.0051)	(0.0201)	(0.0293)	(0.0335)	(0.0184)	(0.0378)	(0.1091)
Primary Abroad	–	-0.0033	-0.0008	-0.0165*	-0.0114	0.0062	-0.0072
		(0.0055)	(0.0091)	(0.0096)	(0.0101)	(0.0183)	(0.0211)
Secondary Abroad	–	0.0107	0.0657**	0.0847**	-0.0024	0.0220	-0.0292
		(0.0168)	(0.0319)	(0.0336)	(0.0244)	(0.0417)	(0.0657)
University Abroad	–	-0.0264	-0.1157***	-0.0848	-0.0258	0.0535	0.1444
		(0.0268)	(0.0355)	(0.0791)	(0.0400)	(0.2707)	(0.1318)
R-squared	0.544	0.468	0.672	0.611	0.395	0.511	0.699
Observations	26816	6409	2150	1186	1470	1442	161

Notes: * (**, ***) Significant at 10% (5%, 1%). See further notes in Table 1 - Panel A. Education categories: *Primary* (years 1-9), *Secondary* (years 10-13) and *University* or post-secondary (years 14+). See further notes in Table 1 - Panel A.

Appendix

Table A1:

Definition of Variables

Variable	Description
Immigrant	Dummy-variable that takes the value 1 if the respondent is born outside Germany and immigrated after 1948
Log wages	Real hourly labor earnings of the individual (in log), includes wages and salary from all employment
Education	Total number of completed years of schooling
Experience	Total number of years of potential labor market experience, computed as current age - years of schooling - 6
Education abroad	Total number of years of schooling completed outside Germany; assumed 0 for natives
Education in Germany	Total number of years of schooling completed in Germany
Experience abroad	Total number of years of experience outside Germany, assumed 0 for natives
Experience in Germany	Total number of years of experience in Germany
YSM	Number of years since migration to Germany
Temporary	Dummy-variable that takes the value 1 if the respondent is an immigrant and reports that he/she does not wish to stay in Germany permanently over the three years preceding the survey year
Region of Origin	
OECD	Dummy-variable that takes the value 1 if the respondent was born in an OECD member-nation, except from Turkey or other non-high income OECD member-nations (as Mexico) or states of the former Soviet Union (Poland, Czech Republic, Slovakia and Hungary)
Turkey	Dummy-variable that takes the value 1 if the respondent was born in Turkey
East Europe/fSU	Dummy-variable that takes the value 1 if the respondent was born in Eastern Europe and/or a state of the former Soviet Union, except from ex-Yugoslavia
Ex-Yugoslavia	Dummy-variable that takes the value 1 if the respondent was born in an ex-Yugoslavian country
Others	Dummy-variable that takes the value 1 if the respondent was born in a country other than the regions specified above
Education Categories	
Primary	Schooling years 1-9
Secondary	Schooling years 10-13
Higher education	Schooling years 14 and above

Table A2:

Descriptive Statistics, Male Full-time workers, 1984-2012

	Natives	Migrants	High Income OECD	Turkey	East Europe/fSU	Ex-Yugoslavia	Others
Age	41.390	42.481	45.451	38.969	41.693	44.317	41.033
	(0.151)	(0.328)	(0.632)	(0.532)	(0.627)	(0.799)	(1.317)
Married	0.642	0.795	0.777	0.868	0.804	0.754	0.614
	(0.007)	(0.013)	(0.025)	(0.018)	(0.025)	(0.042)	(0.077)
Log Hourly Wage	2.665	2.535	2.615	2.434	2.575	2.444	2.585
	(0.006)	(0.013)	(0.032)	(0.018)	(0.021)	(0.020)	(0.070)
Age at Migration	–	20.931	19.275	17.981	24.504	22.556	21.473
		(0.373)	(0.785)	(0.553)	(0.738)	(0.817)	(1.784)
Years since Migration	–	21.558	26.186	21.004	17.190	21.766	19.560
		(0.370)	(0.827)	(0.415)	(0.675)	(0.642)	(2.035)
(I) x Cohort Pre- 1974	–	0.454	0.639	0.447	0.162	0.669	0.348
		(0.019)	(0.038)	(0.032)	(0.031)	(0.042)	(0.090)
(I) x Cohort 1974 to 1988	–	0.269	0.244	0.415	0.248	0.092	0.310
		(0.017)	(0.035)	(0.033)	(0.030)	(0.021)	(0.080)
(I) x Cohort After 1989	–	0.277	0.118	0.137	0.590	0.239	0.342
		(0.015)	(0.024)	(0.023)	(0.035)	(0.039)	(0.075)
Education abroad	–	8.801	8.590	7.522	9.851	9.172	9.627
		(0.175)	(0.448)	(0.250)	(0.250)	(0.300)	(0.961)
Education in Germany	12.258	2.329	2.723	2.772	1.815	1.409	3.143
	(0.043)	(0.163)	(0.406)	(0.246)	(0.230)	(0.255)	(1.071)
Experience abroad	–	6.44	5.18	4.83	8.79	7.59	5.91
		(0.003)	(0.005)	(0.003)	(0.006)	(0.006)	(0.011)
Experience in Germany	23.134	18.912	22.954	17.845	15.234	20.138	16.344
	(0.158)	(0.314)	(0.672)	(0.385)	(0.592)	(0.665)	(1.411)
Total Primary	8.989	8.886	8.822	8.845	8.990	8.873	8.957
	(0.002)	(0.011)	(0.028)	(0.027)	(0.006)	(0.028)	(0.024)
Total Secondary	2.452	1.810	1.799	1.322	2.235	1.582	2.609
	(0.019)	(0.052)	(0.126)	(0.080)	(0.078)	(0.092)	(0.218)
Total University	0.817	0.434	0.693	0.127	0.441	0.127	1.203
	(0.027)	(0.060)	(0.163)	(0.044)	(0.071)	(0.082)	(0.334)
Primary Abroad	–	7.285	6.944	6.737	7.869	7.865	7.241
		(0.114)	(0.270)	(0.201)	(0.168)	(0.189)	(0.651)
Secondary Abroad	–	1.271	1.249	0.731	1.716	1.191	1.879
		(0.057)	(0.143)	(0.073)	(0.086)	(0.118)	(0.277)
University Abroad	–	0.244	0.397	0.054	0.266	0.117	0.507
		(0.041)	(0.113)	(0.018)	(0.059)	(0.082)	(0.150)
Tenure	13.368	10.833	13.254	10.476	8.534	11.421	8.851
	(0.166)	(0.274)	(0.558)	(0.468)	(0.464)	(0.681)	(1.437)
Observations	57870	15461	5314	4453	2812	2494	388

Notes: Weighted sample using weights provided by the SOEP.

Table A3:

Descriptive Statistics, Female Full-time workers, 1984-2012

	Natives	Migrants	High Income OECD	Turkey	East Europe/fSU	Ex-Yugoslavia	Others
Age	38.078	41.798	42.338	39.661	40.771	44.902	39.641
	(0.250)	(0.481)	(0.994)	(1.050)	(0.930)	(0.807)	(2.252)
Married	0.361	0.592	0.593	0.643	0.554	0.601	0.635
	(0.010)	(0.024)	(0.046)	(0.061)	(0.041)	(0.054)	(0.091)
Log Hourly Wage	2.427	2.302	2.342	2.147	2.380	2.267	2.258
	(0.009)	(0.017)	(0.037)	(0.032)	(0.031)	(0.032)	(0.053)
Age at Migration	–	19.603	18.640	15.756	22.503	19.345	19.169
		(0.513)	(0.757)	(1.252)	(1.028)	(1.056)	(2.869)
Years since Migration	–	22.201	23.702	23.931	18.269	25.559	20.478
		(0.554)	(1.150)	(0.858)	(0.887)	(1.198)	(2.888)
(I) x Cohort Pre- 1974	–	0.465	0.578	0.560	0.185	0.725	0.311
		(0.026)	(0.051)	(0.060)	(0.041)	(0.063)	(0.118)
(I) x Cohort 1974 to 1988	–	0.277	0.244	0.421	0.319	0.166	0.195
		(0.023)	(0.040)	(0.059)	(0.041)	(0.058)	(0.067)
(I) x Cohort After 1989	–	0.258	0.177	0.018	0.495	0.109	0.494
		(0.022)	(0.049)	(0.008)	(0.044)	(0.038)	(0.114)
Education abroad	–	8.308	8.577	6.342	9.355	8.090	7.526
		(0.262)	(0.487)	(0.714)	(0.462)	(0.516)	(1.282)
Education in Germany	12.358	2.791	2.522	3.833	2.945	1.847	3.707
	(0.059)	(0.266)	(0.388)	(0.743)	(0.482)	(0.618)	(1.190)
Experience abroad	–	5.68	4.50	4.13	7.45	5.44	6.04
		(0.003)	(0.005)	(0.006)	(0.007)	(0.007)	(0.019)
Experience in Germany	19.722	19.021	20.741	19.352	15.021	23.525	16.370
	(0.260)	(0.508)	(1.144)	(0.676)	(0.772)	(0.990)	(2.236)
Total Primary	8.994	8.825	8.814	8.622	8.989	8.708	8.955
	(0.002)	(0.031)	(0.034)	(0.088)	(0.005)	(0.115)	(0.030)
Total Secondary	2.556	1.807	1.629	1.260	2.625	1.172	1.865
	(0.028)	(0.083)	(0.178)	(0.241)	(0.114)	(0.167)	(0.269)
Total University	0.807	0.467	0.657	0.292	0.685	0.058	0.414
	(0.037)	(0.058)	(0.156)	(0.135)	(0.101)	(0.023)	(0.161)
Primary Abroad	–	6.934	7.068	5.698	7.246	7.422	6.217
		(0.187)	(0.286)	(0.492)	(0.319)	(0.453)	(1.032)
Secondary Abroad	–	1.098	1.082	0.495	1.717	0.658	1.009
		(0.083)	(0.191)	(0.223)	(0.142)	(0.124)	(0.290)
University Abroad	–	0.275	0.427	0.148	0.392	0.010	0.300
		(0.046)	(0.124)	(0.113)	(0.082)	(0.008)	(0.149)
Tenure	9.822	9.538	9.789	10.283	6.934	13.402	6.614
	(0.201)	(0.454)	(0.656)	(1.017)	(0.512)	(1.279)	(1.701)
Observations	26775	6386	2150	1186	1449	1441	160

Notes: Weighted sample using weights provided by the SOEP.