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Abstract

After the crisis years of 2008 and 2009 EU countries followed different employment paths. Employment and wage levels, for instance, are quite unevenly distributed across Europe. Some of the member states expect labour shortages due to demographic change in the future. If this is the case, wages will rise when the shortages occur. From literature on migration it is well known that regions with relatively higher income levels and a lower risk of unemployment are typical destination countries for immigration. Thus, European regions might be expected to become rather mixed in cultural terms in the future. Despite the filling of the labour market and the redistribution of the resource of labour, the ultimate question raised in the discussion is whether there are additional gains or losses due to immigration. This work therefore focuses on the impact of migrants on regional GDP per capita for European regions. Does the proportion of foreigners in the labour force increase or lower regional income? Does the composition of non-natives with respect to their countries of origin matter? Both questions are addressed in this study while controlling for endogeneity. We provide evidence that immigration raises regional income and a tendency towards (roughly classified) dominant foreign-born groups reduces the costs of interaction and integration. Thus, in general immigration has a positive effect on regional performance and the costs of immigration in destination regions are balanced out. Depending on the labour market status of migrants, the regions of origin of migrants within the EU face a rise or decline in income as a result of the outflow.

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1 Introduction

The last few decades have been characterized by improvements in the quality of life and better health services, especially in western countries such, that we are fortunate to live longer. At the same time fertility rates have decreased steadily. As a consequence, firstly countries are becoming older in terms of the average population age and secondly they are going to shrink. This phenomenon, known as demographic change, is well known in scientific literature and is frequently discussed in the policy debate. During such a period a fixed retirement age raises the dependency ratio; then, given a certain production level, labour shortages may occur. Pressure on the social security system increases during a period of demographic change, especially when the population is becoming older. The consequences of potential financial constraints on national finances are less predictable and open.

There are several suggestions as to how to deal with demographic change. The pressure on the social security system might be reduced by increasing the retirement age and women's labour force participation or by recruiting unemployed people. Additionally, paying lower pensions relaxes financial budget constraints. Another option is to increase immigration flows, whereby young educated people are particularly welcome. The hope is that these potential workers may reduce labour shortages, pay into the social security system and partly cushion the adverse effects of demographic change. Economic literature on migration highlights key variables which are related to migration flows. The aim of this study is not to focus on potential immigration flows and their effects on the social security system, but goes one step further: once the migrants settle down, the question is whether there are positive or negative effects on (regional) economic performance due to migration.

One may hypothesize that migrants have different skills and different approaches solving problems, which is advantageous when they work together with people from the host country, and may then increase productivity. Migrants, of course, have detailed knowledge of the cultures of their home countries. Host-country firms may want to enter foreign markets and therefore have an interest in employing migrants of that nationality. As a result of country-specific knowledge the firm may have an advantage and market entry may potentially be more successful. Both examples make it clear that employing migrants may increase productivity. However, negative aspects may also occur. For example in the presence of language barriers or cultural misunderstandings, potential productivity gains may melt away and the net effect on productivity could be zero or even negative.

In economic literature it is argued that migrants have a higher risk of unemployment. Additionally, they potentially suffer from moral hazard when their skills and educational levels are not (fully) accepted. In this case, self-employment is a strategy for migrants to earn an income. They may provide 'cultural' consumption goods such as specialized food, work as specialist hair dressers or Bohemians. Then migrants increase the variety of (local) consumption goods in a region. The increase in heterogeneous products can be seen as consumption amenities such that household utility and welfare may increase. In contrast, the native population might be afraid of foreigners and possibly expect ethnic conflicts or higher crime rates and therefore face a disutility because of immigration. As was the case for the production side, not only the total number of immigrants but also the combination of different nationalities or the cultural backgrounds of migrants may matter.

The net effect of gains and losses of a culturally diverse population is unclear from a theoretical point of view and therefore empirical evidence should be provided. In the following we focus on the impact of migrants on regional economic performance by analysing the impact on GDP per capita. The structure is as follows. The next section reviews related literature. Section 3 provides a theoretical outline of how the cultural background can explain differences in GDP per capita. We adopt an augmented Solow model and derive an empirically testable model. Section 4 introduces the data set and additional control variables and is followed by a descriptive analysis. Section 6 shows regression results and discusses the results of the estimates. Finally, the paper closes with a conclusion.

2 Review of existing literature on cultural diversity

There is a growing stock of literature analysing the influence of cultural diversity on economic performance, mainly through cross-country approaches. An early study in this line is the paper by Easterly and Levine (1997). They pay explicit attention to the remarkable effects of ethnic diversity across countries on economic growth. Easterly and Levine (1997) argue that Africa's growth failure is deeply rooted in the existence of ethnic conflicts and that per capita GDP growth is inversely related to ethno-linguistic fractionalization. For their measurement of ethnic fragmentation they use indices based on ethno-linguistic classification derived from data from the former Soviet Union. Subsequent work confirms their results. Alesina et al. (2002) broaden the empirical approach of Easterly and Levine (1997) by introducing new measures of cultural diversity that permit a differentiation

between ethnic, linguistic and religious fractionalization. They provide substantially different evidence depending on the classification they apply. By analysing the influence on economic growth they broadly confirmed the results obtained by Easterly and Levine (1997) when ethnic and linguistic fractionalization are considered. Both types are associated with negative growth of GDP per capita. However, religious fractionalization does not affect growth rates significantly. Collier (2001) argues that cultural fractionalization has a negative effect on productivity and growth in non-democratic regimes whereas this is not the case for democracies. However, Collier cannot find any significant effects of religious diversity. Inspired by the evidence provided by Collier (2001), Alesina and La Ferrara (2004) revisit the effect of diversity on economic performance and confirms Collier's (2001) finding that religious diversity has no effect on economic growth by employing a fractionalization index. Furthermore they show that the negative effect of diversity is stronger for countries that exhibit lower income levels. Montalvo and Reynal-Querol (2005) argue that both ethno-linguistic and religious diversity may be a potential measure for a strong conflict dimension. Therefore they suggest a new measure which aims to capture the potential for conflict in heterogeneous societies based on a polarization index instead of the fractionalization index. Their results indicate that a higher degree of ethnic and religious polarization has a large and negative impact on economic development through indirect channels such as civil war.

Besides the evidence on losses resulting from cultural diversity, there is also a strand of literature which substantiates the existence of benefits from heterogeneous societies. Ottaviano and Peri (2005) investigate the impact of cultural diversity on the economic life of US cities through the wages of the native population. Allowing for imperfect substitutability between natives and foreigners, the authors find a significant and robust positive correlation between cultural diversity and the wages of white US-born workers. They additionally point out that the benefits emerging from migrants who have integrated are larger than those from new immigrants that have not integrated in the host country. Similarly, Bellini et al. (2008) follow the same idea that cultural diversity may affect both production and consumption through positive or negative externalities. To identify the dominant effect they analysed the joint estimation of a price and income equation. Their results are consistent with those obtained by Ottaviano and Peri (2005) for US cities. They focus on NUTS-3 regions of 12 European countries and provide evidence that diversity is positively correlated with productivity and that the causality runs from the former to the latter.

D'Amuri et al. (2010) investigate the labour market impact of immigration on wages

and employment in western Germany. The group of new migrants mainly affects the employment levels of those in the previous immigration waves. The effect is statistically and economically significant. According to D'Amuri et al. (2010) there is a large adverse employment effect on previous immigrants as well as a small adverse effect on their wages. Interestingly, the impact of (substantial) immigration inflows on the wages and employment levels of natives is relatively small. These asymmetrical results are mainly driven by a higher degree of substitution between 'old' and 'new' migrants in the labour market, for instance due to rigid wages. Suedekum et al. (2009) study the impact of increasing diversity on native employees in western Germany. The analysis is conducted at local level and concludes that diversity raises productivity at this level. Additionally, the study reveals the importance of distinguishing between high- and low-skilled foreign workers. For high-skilled foreign workers, they found that both the size of the group and the diversification into different nationalities increase the local wage and employment for native workers. However, for low-skilled foreign workers the effect is negative. They argue that the presence of high-skilled foreign workers can be regarded as a positive production amenity from a regional perspective. Nathan (2011) reaches a similar conclusion for the UK based on a panel period lasting 16 years. Average productivity and wages rise for UK-born people on average due to immigration. However Nathan (2011) also provides evidence of that natives are crowded out when they compete for similar jobs.

Ratna et al. (2009) and Sparber (2010) analyse the macroeconomic effects of social diversity in the US based on a state level using cross-sectional data. The empirical investigations yield mixed results. Whereas Sparber (2010) was unable to find any causal relationship between diversity and gross state output per worker, Ratna et al. (2009) find evidence that racial diversity reduces GDP growth while linguistic diversity raises GDP growth. They justify their results with the fact that English is frequently used by non-native speakers and so the barriers to communication based on race are more pronounced and enduring than those based on linguistic differences.

Cheng and Li (2011) consider regional and sectoral firm formation and the role of the composition of foreigners in terms of racial and cultural diversity. They especially identify specific sectors where the effect of fragmentation on firm formation is greater. Cheng and Li highlight service sectors with special cultural needs in production to supply culturally diverse products. This evidence confirms the arguments of Ottaviano and Peri (2005) as to why cultural diversity might matter in a positive manner and why foreign-born workers offer different skills.

The empirical contributions cited above focus on a country or regional level. There is a branch of literature focusing on firm level in general or in sub-groups of the labour market, for instance the impact of high-skilled workers on innovation. Niebuhr (2010) investigates the impact of cultural diversity in the workforce on regional innovation output. She bases her research on a production function which relates innovative output to R&D input. Instead of using the number of patent applications, she investigates the relationship between patents and R&D input in per capita terms due to the fact that patent application is also affected by the size of the regional economy. Furthermore, in order to model the relationship between R&D input and output appropriately, Niebuhr (2010) adds the input variable with a time lag of one year. The regression results support the hypothesis that differences in the knowledge and capabilities of workers from diverse cultural backgrounds may enhance the performance of regional R&D sectors. Beyond that, the results stress the importance of distinguishing between high- and low-skilled workers. Diversity among highly qualified employees is found to have the strongest impact on innovation output. However, these effects are based on a diversity measure which refers to employed migrants, so the positive impact can only be associated with immigrants who have already integrated. Inspired by the research of Niebuhr (2010), Ozgen et al. (2011) discuss various effects of immigration on the innovativeness of European regions. They base their measures of innovation on the means of the number and types of patent applications. Ozgen et al. (2011) argue that regions with many immigrants might also have a larger number of patent application. However, they suggest that there might be an optimum level for cultural diversity, because the benefits gained from diversity appear to decrease when a value of the fractionalization index exceeds a critical point. The work of Parrotta et al. (2011) also confirms the positive impact of cultural diversity on innovativeness within firms, explaining the incentives for patenting, the number (mass) of patents and the ability to patent in various, distinct fields.

Besides the impact of innovation on firm performance, Brunow and Blien (2010) and Parrotta et al. (2010) focus on the impact of cultural diversity on establishment productivity. Brunow and Blien (2010) find evidence of productivity gains when the employed labour force is more diverse. Diversity is measured on the basis of the information about the employees' nationalities. They also find negative effects, however, which they relate to the "Babel" effect. The more foreign nationalities are employed the lower productivity is. The study by Parrotta et al. (2010) partially supports these findings. In this work, positive effects are due to human capital diversity, especially in skills and education. Ethnic diversity has no or only an insignificant impact on firms' total factor productivity.

So far, the focus has been on regional or firm level. Additionally, attention was paid to innovativeness resulting from a culturally diverse work force, which is also related to production. Longhi (2011) analyses the impact of cultural diversity on individual wages and on various aspects of job satisfaction. In her study significant effects occur as long as endogeneity and individual fixed effects are not controlled for. If this is done, the positive effect of the simpler econometric model disappears. However, the simpler model also considers variation between individuals. Then, living in a more rather than a less diverse environment adds a premium in terms of wages or job satisfaction.

Based on the evidence in the literature we conclude that the effect of cultural diversity on productivity or growth is unclear and depends on the measure applied, the level of aggregation and the underlying background (racial, ethnic, linguistic, etc.). Most studies identify gains as long as conflicts are not considered, but the literature also shows that negative effects occur as well. Thus, based on the review we expect a positive, a negative or an insignificant impact of cultural diversity on regional income. Most studies in this field use cross-sectional data to identify the effect. However, Islam (1995) discusses a serious parameter bias when country- or region-specific effects are not taken into account.

The next section derives the theoretical framework to test the relevance of cultural diversity on regional productivity empirically while controlling for fixed effects.

3 Theoretical framework

In the introduction several mechanisms suggest that a culturally diverse population may yield gains or losses. They might occur on the production or the consumption side. Some studies focus on firm or establishment data to reveal these effects from a production-side perspective. However, these studies cannot focus on the consumption side directly. We are interested in the general effect at regional level. Regional income Y is generated by K units of capital and L units of labour and H units of human capital under constant returns to scale. We adopt the production technology suggested by Mankiw, Romer and Weil (1992) and augment it by a (culturally) heterogeneous labour force as Ottaviano and Peri (2005) suggest. The production function reads as

$$Y = A(\cdot) K^\alpha H^\beta \left[(1 - \tau) \left(\sum_{m=1}^M (L_m)^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}} \right]^{1-\alpha-\beta} \quad (1)$$

where $A(\cdot)$ describes the total factor productivity, which grows at an exogenous rate g . The parameter σ relates to the elasticity of substitution between employees of M different cultural backgrounds. Ottaviano and Peri (2005) also introduce a negative effect of cultural diversity from a theoretical perspective and capture this issue in $1 - \tau$, $0 \leq \tau \leq 1$. Like Ottaviano and Peri (2005), we see τ as an increasing function of the degree of cultural diversity. Then, $1 - \tau$ captures a potential negative effect of a culturally diverse labour force on regional productivity. In contrast, the CES index introduces gains from cultural diversity. Let $s_m = L_m/L$ be the proportion of employees from the m th employed cultural group, then we can simplify (1) to

$$Y = A(\cdot) K^\alpha H^\beta L^{1-\alpha-\beta} \left[(1 - \tau) \underbrace{\left(\sum_{m=1}^M s_m^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}}_{DIV} \right]^{1-\alpha-\beta} \quad (2)$$

$$= A(\cdot) K^\alpha H^\beta L^{1-\alpha-\beta} [(1 - \tau) DIV]^{1-\alpha-\beta} \quad (3)$$

Obviously the culturally diverse labour force can be understood as a Hicks-neutral process. We divide total production Y by the regional population B and follow the decomposition of the labour force suggested by Brunow and Hirte (2006). This approach introduces labour market variables into our model, namely participation p and the unemployment rate u . Finally, output per capita is given by

$$y = \frac{Y}{B} = A(\cdot) k^\alpha h^\beta [p(1 - u)]^{1-\alpha-\beta} [(1 - \tau) DIV]^{1-\alpha-\beta}. \quad (4)$$

This equation contains the stock of physical and human capital per capita as explanatory variables. Both variables are highly endogenous because they depend on relative prices. For that reason we derive the steady state value. We assume a common and constant depreciation rate δ for both types of capital and assume that the labour force grows at rate n . We refrain from modelling technological progress, since our time period is rather short.

We label s_k and s_h as the investment share of total output for physical and human capital, respectively. The dynamic equations and the steady-state values read as

$$dk = s_k y - (n + g + \delta) k, \quad k^* = \frac{s_k y}{(n + g + \delta)} \quad (5)$$

$$dh = s_h y - (n + g + \delta) h, \quad h^* = \frac{s_h y}{(n + g + \delta)} \quad (6)$$

and are expected to be zero in the long-run. With some manipulations we eventually derive the steady state level for output per capita y^* using the equations (4), (5) and (6), given by

$$y^* = A(\cdot)^{\frac{1}{1-\alpha-\beta}} (n + g + \delta)^{-\frac{\alpha+\beta}{1-\alpha-\beta}} (s_k)^{\frac{\alpha}{1-\alpha-\beta}} (s_h)^{\frac{\beta}{1-\alpha-\beta}} [p(1-u)] [(1-\tau) DIV]. \quad (7)$$

This equation is the baseline for our empirical specification and describes the influence of variables on differences in steady-state values. For instance, a larger share of human capital raises income, whereas a relatively lower participation rate reduces regional GDP per capita. Mankiw, Romer and Weil additionally derive a growth regression where regional income growth is explained by the income level at the beginning of the time period. As is shown below, our data set covers a relatively short time period. This means that we cannot take sufficiently into account the endogeneity problem described by Caselli et al. (1996). Therefore we keep to our approach and answer the question of whether differences in income are additionally explained by distinct levels of regional cultural diversity. Islam (1995) points out that parameter estimates are potentially biased when region-specific effects are not taken into account. Since our research fields are regions which we observe over time, we control for region-specific effects μ_r and time fixed effects μ_t . The work of Lopez-Bazo et. al. (2004), Ertur and Koch (2007), and most recently Fischer (2011) extend the neoclassical growth specification to take into consideration technological interdependence, physical and human capital externalities appearing among regions. What all these approaches have in common is that spatial dependencies between regions are controlled for. However, these models are suitable for an investigation examining cross-sectional data in the context of economic growth. At this stage of the analysis we retain the parsimonious model which does not control for inter-regional spillover effects, and focus on the diversity issue while employing panel data.

Taking the log of (7) and adding an error term yields our regression model

$$\begin{aligned} \ln y_r = & \alpha_0 + \alpha_1 \ln(n_r + g + \delta) + \alpha_2 \ln s_{kr} + \alpha_3 \ln s_{hr} \\ & + \alpha_4 \ln [p_r (1 - u_r)] + \alpha_5 \ln [(1 - \tau_r) DIV_r] + \mu_r + \mu_t + \varepsilon_r, \end{aligned}$$

which we examine empirically in the next sections.

4 Variables and data

This section presents our data set and the construction of variables and provides a descriptive analysis.

We combine the Eurostat regional database with the European Labour Force Survey (ELFS), both provided by Eurostat, the Statistical Office of the EU. The regional classification is based on the NUTS 2 level of aggregation. The advantage of the NUTS 2 over the NUTS 3 level is that it overcomes strong spatial interdependencies emerging at the NUTS 3 level due to a common labour market and commuting flows between regions or vertical linkages of upstreaming industries nearby located.

The ELFS data come from a household survey which basically gathers labour market characteristics and individual information about household members. It is representative at the NUTS 2 level. Our panel spans the time period from 2003 to 2008. Detailed information on the cultural background is only available from 2004 until 2008. Therefore the data from 2003 are only needed for the construction of lagged values. There are no data on the cultural background for Polish regions, so we have to exclude Poland from our sample. The same problem appears for Italy in 2004, so we cannot construct lagged variables for Italian regions in 2005. There is also a lack of data for some countries in individual years, which means that we are considering an unbalanced panel. Furthermore, we can only consider Norway and Iceland as single regions, i.e. at the country level. Because of unreasonable values for 2006 and 2007 we have to exclude the French region FR83 for both years. We also exclude some Spanish regions (the exclaves ES63, ES64, and the Canary Islands ES70) and the Portuguese islands (Azores PT20 and Madeira PT30).

Because the ELFS is a household survey it does not necessarily represent the regional population. Each respondent is therefore assigned an individual weighting factor in order to ensure representativeness. The factors are provided along with the ELFS data. We take these weighting factors in account when we construct and aggregate variables at regional level.

From the regional data basis of Eurostat we use data for the Gross Domestic Product (GDP) measured in purchasing power parities to take different price levels into account. Furthermore, we use the regional population data to construct the GDP per capita measure as a proxy for $\ln y_r$. The population growth rate n_r is constructed using the difference between births and deaths relative to the population. For the UK these data are not available, so we calculate n_r as the change in the population instead.

Based on the regional gross investments we might compute the investment share to

cover the capital investments s_k . Unfortunately, capital investment data are not available for all time periods and in particular not for the UK. We therefore have to exclude the investment variable and face an omitted variable bias. The bias is reduced because of the fixed effects model.

The ELFS collects information about the educational level of respondents. We use that information to construct the proxy of human capital s_h , measured as the proportion of people holding a university degree. As a proxy for s_h we use the lagged values because it is reasonable to assume that returns on investments occur some time later. In addition we construct the proportion of migrants with a university degree relative to all people with such a degree and label it as $s_h^{migrants}$. The term $p_r(1 - u_r)$ which described the labour market is also calculated on the basis of the ELFS data, and is covered by the questions about participation and unemployment. Variables capturing the cultural background are also taken from the ELFS, which provides two types of information on this issue. First, respondents are asked for their country of birth, and second for their nationality, both of which are grouped into 8 macro-regions. Since we are more interested in cultural differences and not in the legal status, we use the country of birth to compute diversity measures. Because in some countries the country of birth was not surveyed or respondents did not answer, we use nationality as a weaker proxy instead².

As our model suggests, the cultural background of employees or self-employed individuals is mainly of importance, since we focus on production. Therefore, we do not consider children up to the age of 15 or pensioners³. Another reason to exclude children is that some countries do not report individuals under the age of 16.

Besides the proportion of foreigners $s_{migrants}$, we also compute measures that capture the degree of diversity among foreigners. As outlined in the literature review, various measures are suggested. It is worth noting that there is no best proxy and therefore we compute three common measures, namely the fractionalization index, a Herfindahl-like index and finally a polarization index. Let s_m be the proportion of the m th group of M

²This is especially the case for Germany.

³We still include respondents over the age of 65 who are active in the labour market.

cultural groups, then the different measures are calculated as follows,

$$Fractionalization = \sum_m^M s_m^{0.66}, \quad (8)$$

$$neg. Herfindahl = 1 - \sum_m^M s_m^2, \quad (9)$$

$$Polarization = 1 - \sum_m^M \left[\left(\frac{0.5 - s_m}{0.5} \right)^2 s_m \right]. \quad (10)$$

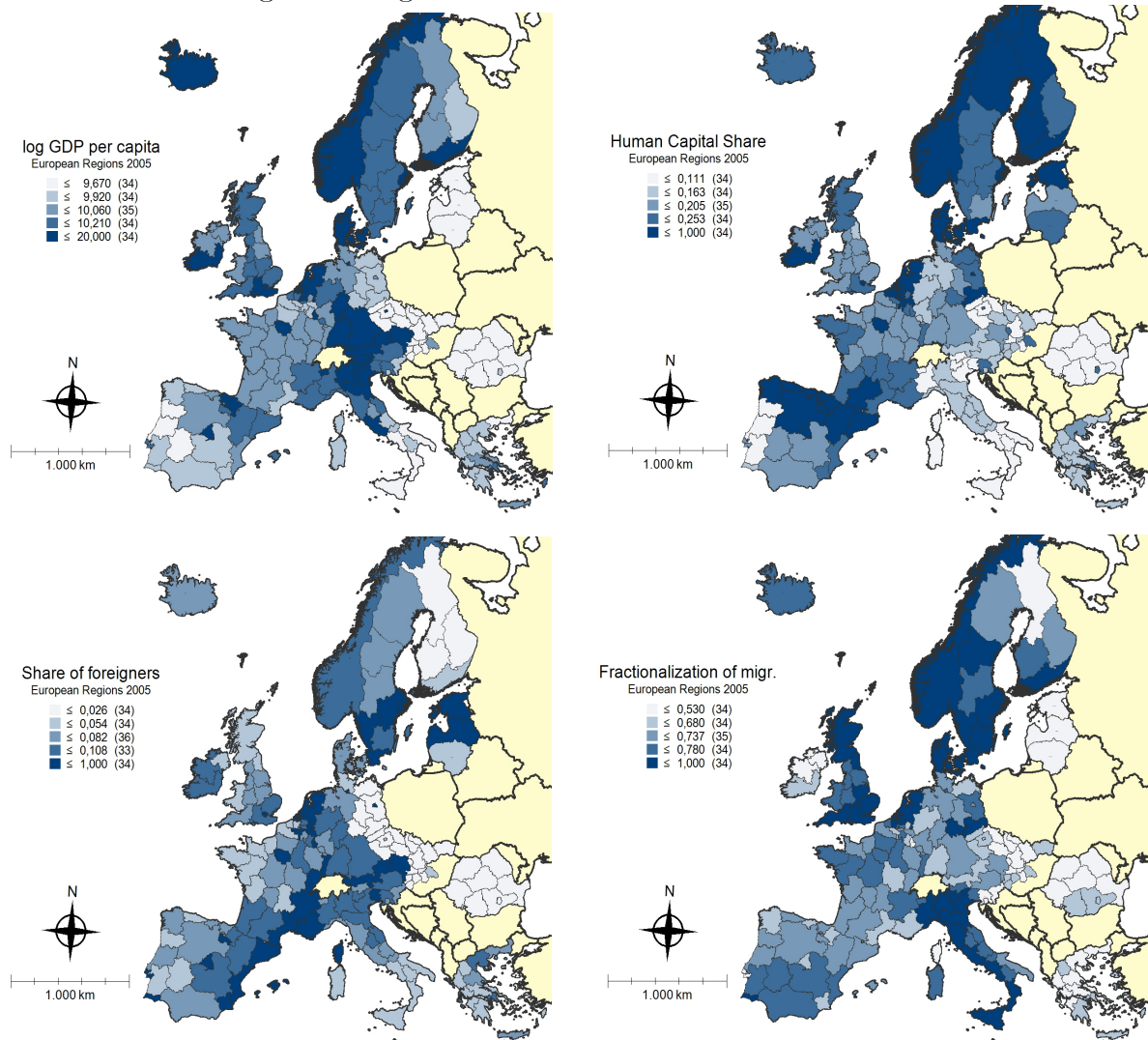
There is a crucial difference between the first two measures and the third one. The fractionalization and the Herfindahl-like measures increase with the degree of cultural diversity and especially the more equally distributed the shares are. The polarization index, on the other hand, increases in the presence of two dominant groups. As can easily be seen, when there are two groups, each with a share of 0.5, the index reaches its maximum at 1. Thus the polarization index identifies the presence of two dominant groups out of M distinct groups.

After the presentation of the data and the variables under consideration, we now turn our attention to the descriptive analysis.

5 Descriptive analysis

The upper part of Figure 1 shows the income distribution on the left and the proportion of human capital on the right. The second row displays the distribution of non-natives as a proportion of the total population and the diversity among non-natives. The band width is chosen in such a way that each class contains approximately the same number of observations, so that the interpretation of each colour is equal to percentiles. The regions coloured yellow are those not included in the data set. The data relate to the year 2005.

Figure 1: Regional distribution of main variables



As can be seen, the proportion of migrants is not necessarily larger in wealthier regions, although there is still a clear pattern in which regions with higher incomes are in favour of in-migration and therefore, the share of non-natives increases. Interestingly, even more than 15 years after the breakdown of the socialist countries, the proportion of foreigners is still small in these regions. The cultural mix among foreigners is shown in the lower right panel. It reveals that regions with a relatively low level of non-natives could nevertheless be highly diverse in cultural terms. There are also regions with a large proportion of immigrants and a high degree of diversity. In contrast, a large proportion of non-natives and low diversity means that there has to be a dominant group of foreigners, since the measure increases with the degree of diversity.

Figure 2: Correlation between GDP per capita and the share of non-natives

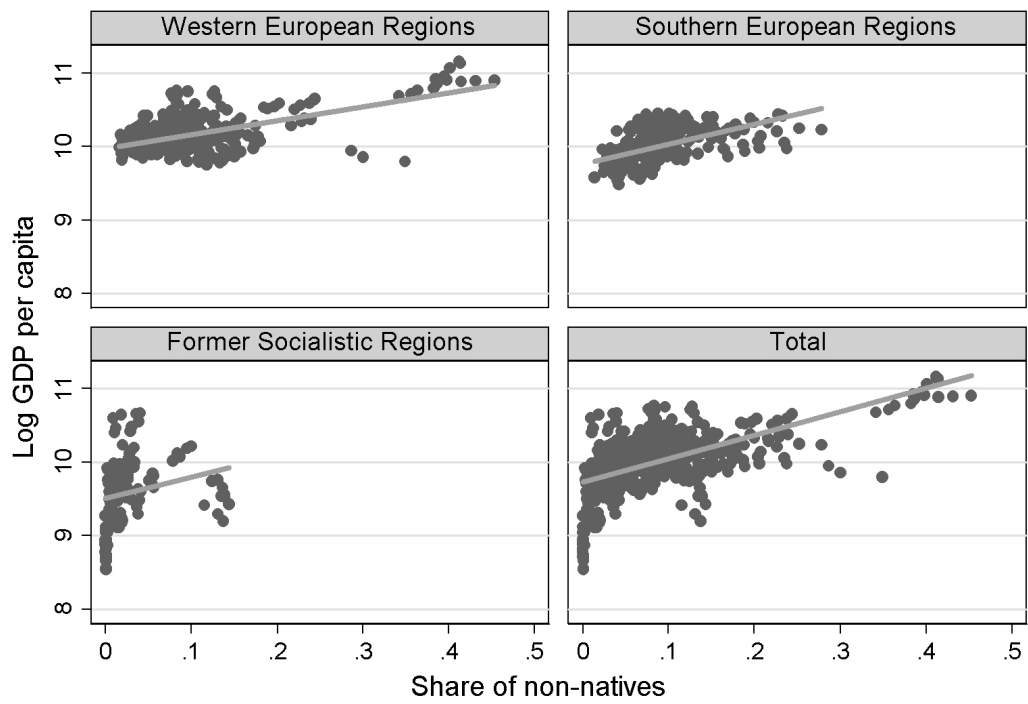


Figure 2 plots the proportion of non-natives against the log of GDP per capita within regions to obtain deeper insights into a potential correlation. The larger the proportion of migrants the higher GDP per capita is, giving a first indication that migrants may improve regional productivity and income. Interestingly, this pattern holds for different European macro-regions in which the average income and the immigration history are quite distinct. However, endogeneity issues also arise: A well-performing region, whether wealthy or not, may offer higher wages, making this region more attractive for immigration relative to other regions. We should therefore focus on the immigration structure and the distribution of migrants.

Table 1 provides a descriptive overview of the proportion of migrants as a percentage of the population in EU macro-regions for the years 2004 and 2008. Besides the average proportion of the total population, the relative average proportion of the foreign population is also reported. As can be seen, the data only allow the observation of 8 distinct groups of migrants. The diversity measures are calculated from these groups. For instance, in western European regions the average proportion of EU 15 foreigners in the total population is 3.6 % and these 3.6% are 35.5% of all foreigners in 2004. As shown, the cultural mix increased in all three macro-regions during the sample period. Interestingly, migrants from former socialist countries seem to settle more frequently in the southern parts of Europe. On the other hand, eastern European regions mainly attract people from the EU itself but not from the rest of the world. Focusing on the relative proportion of all foreigners reveals that the former socialist regions mainly attract foreigners from other former socialist regions. This could be because of language similarities (Slavic languages). The descriptive table does not immediately confirm the fact that migrants prefer only regions with higher income levels for immigration, because $s_{migrants}$ rose in all sub-groups of European regions.

What is also known from migration literature is that migrants tend to settle in regions with a lower risk of unemployment. This probability is generally lower in more densely populated regions. The proportion of human capital is also larger in densely populated (agglomeration) regions, which raise problems of identification when the two variables are correlated with each another. A simple correlation between the proportion of migrants and the human capital measure $\ln s_h$ is 0.40, which provides first evidence of this. The correlation after absorbing the region fixed effects is even higher, namely 0.45.

Table 2 provides an overview of our main variables, some of them not presented in log form. Besides the total variation of the sample it also reports the variation after the fixed effects transformation has been performed. In the latter case no mean reported, since it

Table 1: Average and relative population share of migrants within EU regions

	European Regions					
	West¹		South²		Former Soc.³	
	share ^A	relative ^B	share ^A	relative ^B	share ^A	relative ^B
2004 (as %)						
EU 15	3.6	35.5	1.1	18.6	0.1	6.2
New Member States 12	0.4	4.7	0.7	11.2	0.6	47.2
Europe outside EU 27	1.7	18.6	1.6	28.2	1.4	37.4
Other Africa	0.8	8.0	0.7	8.3	0.0	1.0
North Africa, Near/Middle East	1.8	16.2	0.5	6.4	0.1	1.7
East and South Asia	1.0	10.9	0.1	1.5	0.1	4.5
Latin America	0.3	3.0	1.7	23.1	0.0	1.0
North America and Australia	0.3	3.0	0.1	2.7	0.0	0.9
Share of non-natives $s_{migrants}$	9.9		6.5		2.3	
2008 (as %)						
EU 15	4.1	33.8	1.3	14.3	0.1	4.3
New Member States 12	0.9	7.2	1.6	14.6	0.9	49.6
Europe outside EU 27	1.9	19.3	2.3	27.3	1.8	34.9
Other Africa	1.0	8.9	0.7	6.0	0.0	0.1
North Africa, Near/Middle East	2.2	19.2	1.2	10.8	0.2	5.0
East and South Asia	0.7	7.0	0.5	4.6	0.1	4.3
Latin America	0.3	2.8	2.7	19.9	0.0	0.8
North America and Australia	0.2	2.0	0.2	2.5	0.0	1.0
Share of non-natives $s_{migrants}$	11.3		10.5		3.1	

¹ AT, BE, DE excl. eastern Germany, DK, FI, FR, IE, IS, LU, NL, NO, SE, UK; ² ES, GR, IT, PT;

³ CZ, EE, HU, LT, LV, PL, RO, SI, SK, eastern Germany;

^A Share of group as a % of the total population; ^B share of group as a % of the foreign population; Source: EU Labour Force Survey; own calculations

is zero. There are some regions with very low participation and employment levels, which in turn means a very high dependency ratio. On the other hand, in some regions over half of the population participates in the labour market and works. When we examine the transformed data set we find that changes in participation and unemployment rates occur. Focusing on $n + g + \delta$ clearly shows that European regions do not grow or shrink much during the sample period in terms of population growth. Both, δ and g are fixed values and we use 0.08 for the sum, which is a common value emerging in the literature.

The average proportion of migrants within regions is 8% and ranges from zero to over 45%. The regions with the largest proportion of non-natives are Brussels, London and Luxemburg.

Table 2: Overview of main variables

	Overall variation				Fixed effects transformed			
	Mean	Std. Dev.	Min	Max	Std. Dev.	Min	Max	
$\ln y$	9.989	0.37	8.537	11.156	0.062	-0.233	0.214	
$p(1 - u)$	0.43	0.049	0.256	0.563	0.01	-0.036	0.032	
$(n + g + \delta)$	0.05	0.003	0.074	0.091	0	-0.002	0.003	
s_h	0.192	0.074	0.059	0.413	0.016	-0.094	0.058	
$s_h^{migrants}$	0.079	0.07	0	0.586	0.014	-0.067	0.094	
$s_{migrants}$	0.081	0.068	0	0.453	0.013	-0.066	0.065	
<i>Fractionalization</i>	1.673	0.207	1	1.96	0.057	-0.423	0.293	
<i>neg. Herfindahl</i>	0.641	0.175	0	0.845	0.055	-0.462	0.266	
<i>Polarization</i>	0.673	0.137	0	1	0.069	-0.656	0.532	

Note: Some variables not in log form; Source: EU Labour Force Survey; own calculations

The correlation structure between the diversity measures and the log of GDP per capita is 0.5 for the fractionalization index, 0.4 for the Herfindahl-like index and about 0.1 for the polarization index. All three correlation structures vanish after the fixed effects transformation. The correlation drops to values between 0.02 and 0.07. The impact of the combination of migrants on income might be negligible. The first impression obtained by using bivariate correlation seems to suggest that immigration has a positive effect on regional income. However, does this picture remain when other effects are controlled for? To this end the next section focuses on regression analysis.

6 Regression analysis

In the previous section we derived a regression model inspired by a neoclassical production function which reads as

$$\begin{aligned} \ln y_r = & \alpha_0 + \alpha_1 \ln (n_r + g + \delta) + \alpha_2 \ln s_{kr} + \alpha_3 \ln s_{hr} \\ & + \alpha_4 \ln [p_r (1 - u_r)] + \alpha_5 \ln [(1 - \tau_r) DIV_r] + \mu_r + \mu_t + \varepsilon_r. \end{aligned}$$

There are no data available for regional investments. Therefore α_2 cannot be estimated and the time-constant part of s_{kr} is contained in the region-specific effect μ_r . Because of the complementary and substitutable relationship between s_h and s_k , the explanatory variables are correlated with μ_r . Therefore a fixed effects model is preferred over random effects models on the basis of theory. This result is confirmed when estimates of the random effects model are compared with the fixed effects estimates. We therefore do not provide random effects estimates due to their inconsistency. We operationalize the $(1 - \tau) DIV$ term by using $s_{migrants}$ and the different diversity measures.

As already mentioned, the migration decision is made on the basis of wage differentials between migrant's potential host country and his or her home country. One might expect better performing regions to attract foreigners more frequently, which in turn would raise the proportion of non-natives in that particular region. We partially overcome that problem by using a regional fixed effects model but also explicitly control for endogeneity. Any estimates are efficient for arbitrary heteroscedasticity. In all of the models region-specific fixed effects and time fixed effects are controlled for. Additionally, increases in productivity and thus in income in former socialist countries might be expected. This catch-up effect cannot be explained by the variables under consideration. Therefore we also interact the time dummies with a dummy variable for Eastern European regions including eastern Germany (without Berlin) and add it to our empirical model. It emerges that these dummy variables are always highly significant and positive⁴, providing evidence of this catch-up effect.

We estimate various models. The **Base** model does not control for cultural diversity issues. The **Share** model considers the proportion of all non-natives in the population, $s_{migrants}$. If the proportion exhibits a positive sign, then there is a positive correlation between GDP per capita and the proportion, as suggested in Figure 2. Note that in the

⁴The reference year for the dummy estimates is 2004.

fixed effects analysis we cannot state that an increase in the number of migrants improves regional income because we do not test causality. Models **DIV 1** to **DIV 3** control for the fragmentation of the non-natives in a particular region, employing the fractionalization index (**DIV 1**), the Herfindahl-like index (**DIV 2**) and finally the polarization index (**DIV 3**) as outlined in equations (8) to (10). These three models answer the question of whether there are additional gains (or losses) the more fragmented (diverse) the non-natives are with respect to their country of birth or whether a tendency towards dominant groups raises GDP per capita.

Table 3: Panel Fixed Effects Regression on GDP per capita for EU regions

$\ln y$	Base	Share	DIV 1	DIV 2	DIV 3
$\ln [p(1-u)]$	0.419*** (0.085)	0.418*** (0.085)	0.418*** (0.085)	0.418*** (0.085)	0.409*** (0.083)
$\ln(n+g+\delta)$	0.005*** (0.002)	0.005*** (0.002)	0.005*** (0.002)	0.005*** (0.002)	0.005*** (0.002)
$lag \ln s_h$	0.097*** (0.016)	0.092*** (0.017)	0.092*** (0.017)	0.092*** (0.017)	0.092*** (0.017)
$s_{migrants}$		0.098 (0.077)	0.098 (0.077)	0.098 (0.077)	0.092 (0.079)
$Diversity^1$			0.002 (0.022)	0 (0.026)	0.032 (0.026)
Region Fixed Effects, Time Fixed Effects, East European Countries*Time Fixed Effects					
F	172.0***	163.0***	150.1***	150.9***	152.7***
RMSE	0.021	0.021	0.021	0.021	0.021
within R2	0.881	0.882	0.882	0.882	0.882
overall R2	0.234	0.264	0.266	0.264	0.261
between R2	0.278	0.317	0.322	0.318	0.318
valid cases	741	741	741	741	741
No. of regions	171	171	171	171	171

Note: robust s.e. in (); * $p < .1$; ** $p < .05$; *** $p < .01$; ¹ Diversity measures are the fractionalization index for DIV 1, the Herfindahl index for DIV 2, and the polarization index for DIV3

The fixed effects regression analysis provides first results, which are presented in Table 3. A look at the F-test of the estimation results shows that the explanatory variables of our models are jointly significant. Let us take a first look at the evidence. An increase in the participation and employment rates is positive and highly significant. Of course, the

lower the dependency ratio, the higher the sum of wage payments is and this in turn makes a region relatively wealthier. In the context of demographic change the participation rate will decline during the transition period, when the proportion of the elderly as a percentage of the total population is relatively larger, which lowers regional income.

Contradicting neoclassical theory, an increase in $n + g + \delta$ raises GDP per capita. As Ozgen et al (2010) show by conducting a meta-analysis, a positive value is expected in the case of spillover effects of technological progress. This positive value is very robust even in the IV estimates shown below. In the computation $g + \delta$ was set at 0.08 where we assume that $g = 0.03$ and $\delta = 0.05$. The study by Fischer (2011) suggests the frequently used value of $g + \delta = 0.05$. Using this value changes the results with respect to the $\ln(n + g + \delta)$ term. It is then negative and significant for the proportion and diversity models. It exhibits parameter values in the range of -0.11 to -0.15. These values are insignificant when the endogeneity of foreigners is controlled for. Despite the sign and significance of the $\ln(n + g + \delta)$ term, most of the other estimates are unaffected with regard to its value and significance such that our conclusion does not depend on the definition of $g + \delta$.

As expected, an increasing stock of human capital improves regional performance and thus GDP per capita. The elasticity is about 9.3 %. A larger stock of human capital promotes regional income. We will discuss the influence of human capital in more detail later, when the endogeneity of foreigners is controlled for.

Bearing Figure 2 in mind, it is somewhat surprising that neither the proportion nor the diversity of immigrants has a significant impact on regional income, although one might expect the proportion to have a positive impact. Once we control for region and time fixed effects and other well established variables, the possible positive effect of cultural diversity disappears.

However, as was mentioned earlier, the proportion of migrants is highly endogenous. We therefore estimate the same models but treat the proportion of migrants as an endogenous variable. From migration literature we know that network effects of migrants exist. Additionally, if a region and its neighbouring regions already accommodate a larger proportion of foreigners, then this region might be favourable for new migrants, because this is an established immigration/ destination area. We therefore add two instruments to explain the current proportion of migrants: first, the proportion in the previous period as an internal instrument. Second, we define an average proportion of migrants in all other regions in the previous period as an external instrument. When computing this instrument we use a distance-based weighting matrix to give nearby regions a higher weight

compared to regions further away. This can be understood as a kind of migrant potential. If, for instance, a region has a relatively large proportion of migrants but the neighbouring regions have hardly any migrants, this region might not be particularly attractive for further immigrants compared to a region whose neighbouring regions also have a large number of migrants.

The estimates of the instrumental variable approach are presented in table 4 and the parameters are derived employing GMM⁵. All parameters are jointly significant, as reported by the F-Test. The Hausman specification test compares the IV estimates with the estimates of the fixed effects model presented in table 3. The Hausman test is valid as the basis of homoscedasticity and is therefore performed under this assumption. The test statistics indicate that the IV fixed effects models should be preferred over the fixed effects model. A general problem in IV regressions is that of under- and overidentification. We therefore provide the Sargan and Hansen J test for overidentification and the Kleibergen-Paap LM statistics of underidentification (weak instruments). The instruments are strong enough as confirmed by the Kleibergen-Paap test. The tests for overidentification are also insignificant, indicating that our instruments are uncorrelated with the error term of the regression. This is the relevant assumption for the validity of the chosen instruments. Other test statistics which are not presented here are in line with the reported statistics.

The overall picture of the estimates concerning variables which do not relate to cultural issues are unaffected by the instrumental variable approach. The lagged value of the human capital variable is only half of its original size, indicating that the parameter was upwardly biased when the endogeneity of foreigners was not explicitly controlled for. As already mentioned in the descriptive section, the proportion of high-skilled workers and the proportion of foreigners are correlated. The proportion of foreigners was downwardly biased in the pure fixed effects model. Once we control for endogeneity, $s_{migrants}$ is no longer downwardly biased and the human capital measure is upwardly biased.

With respect to content, regions offer higher incomes the more human-capital-intensive their production is. Rural regions within the EU typically do not attract much human capital because of a lack of relevant employment opportunities. Persistent regional disparities are expected to be present and are a constant, long-term outcome within the EU.

The proportion of migrants is significant when its endogeneity is explicitly controlled for. We find a significant positive impact of immigrants on average GDP per capita. Note

⁵We use the STATA Package `xtivreg2`, provided by Schaffer (2010).

Table 4: Panel Fixed Effects Instrumental Variable Regression on GDP per capita for EU regions

$\ln y$	IV Share2	IV DIV 1	IV DIV 2	IV DIV 3
$\ln [p(1-u)]$	0.338*** (0.101)	0.336*** (0.101)	0.337*** (0.101)	0.321*** (0.100)
$\ln (n + g + \delta)$	0.004* (0.002)	0.004* (0.002)	0.004* (0.002)	0.004* (0.002)
$lag \ln s_h$	0.037* (0.02)	0.038** (0.019)	0.037* (0.020)	0.036* (0.019)
$s_{migrants}$	0.981*** (0.372)	0.945*** (0.354)	0.984*** (0.375)	0.916*** (0.348)
$Diversity^1$		-0.016 (0.019)	0.004 (0.022)	0.058** (0.024)
Region Fixed Effects, Time Fixed Effects, East European Countries*Time Fixed Effects				
F	187.7***	174.9***	173.7***	180.9***
RMSE	0.022	0.021	0.022	0.021
within R2	0.854	0.856	0.854	0.861
valid cases	556	556	556	556
No. of regions	160	160	160	160
Sargan Test Value	0.022	0.016	0.025	0.001
Hansen J Test Value	0.021	0.015	0.023	0.001
Kleibergen-Paap	11.9***	12.5***	11.8***	12.2***
Hausman Test	590.5***	257.9***	73.5***	-1091.1

Note: robust s.e. in (); * p<.1; ** p<.05; *** p<.01; ¹ Diversity measures are the fractionalization index for DIV 1, the Herfindahl index for DIV 2, and the polarization index for DIV 3. Sargan and Hausman test valid for the assumption of homoscedasticity

that the effect is rather small since the share of migrants does not enter the regression model in log form. An increase in the share of migrants by 1 percentage point yields an income growth⁶ of almost 0.01. This estimate is lower than that obtained by Ozgen et al. (2010) who report a value of 0.1 based on meta-analytic evidence. In our case, a 1% increase in the proportion of foreigners in a regions means a fairly large inflow of migrants at NUTS 2 level. The overall effect of immigration in EU regions is thus positive but small.

So far we have considered immigration, but what about the migrants' region of origin, especially when it is one of the regions in our sample? First, when it is mainly employed workers that migrate, then the dependency ratio of outflow -regions will rise. This effect is captured in the $\ln p(1 - u)$ term. Then, an outflow of workers results in a loss of regional income. If, however, unemployed or economically inactive people leave, then the dependency ratio will decline and the impact on regional GDP per capita will be positive. Thus, depending on the migrants' employment status, the outflow -regions do not necessarily deteriorate. The study of Basile et al. (2010) surveys related literature. They work out that eastern European regions face a reduction of unemployment because of the outflow of individuals. However, Basile et al. (2010) also show in their review that unemployment level equalisation is not given. Etzo (2011) concludes that wage differentials and unemployment levels are push factors that influence the decision for the out-migration in the case of Italy. Based on the evidence of existing literature we might conclude that regions gain from out-migration.

Focusing on the diversity issue reveals that fragmentation among foreigners does not matter with regard to the Herfindahl and the fractionalization indices. The composition becomes significant for the polarization index. As was shown in the literature review, the results depend strongly on the measures applied. At least the estimate of the polarization index is positive, which indicates that a culturally diverse region gains when there is a tendency towards two dominant foreign groups. Then, a balanced blend of foreigners belonging to one of the two groups seems to raise GDP per capita. According to Ottaviano and Peri (2005) different groups of foreigners offer special skills, so a mixture of all cultures should be favourable. Some reasons for the proportion and also the diversity measure having a positive impact are that migrants provide heterogeneous products, possess different skills and possibly select into distinct jobs and tasks that suit them best. Then, labour resources are distributed among jobs where they offer the highest

⁶With regard to immigration, the income growth rate is defined as $dy/y = \beta * ds_{migrant}$, ceteris paribus.

returns. Based on the results of the diversity measures and especially the polarization index we conclude that regions have an advantage when there is a tendency towards dominant groups, which contradicts the findings of Ottaviano and Peri at first sight. With the European Labour Force Survey data, we are able to consider only 8 distinct cultural backgrounds of foreigners, though they have quite different cultural histories even within these roughly classified groups. Obviously, an increase in diversity as it is captured by the Herfindahl-like measures of models DIV 1 and DIV2 does not foster income gains. This does not mean that cultural diversity reduces income. The polarization index only states that a region has an advantage when the distribution of migrants tends towards dominant groups. However, within each group the mixture of different cultural backgrounds could be high. This diversity is not captured in the diversity measures but in the proportion of migrants, which is highly significant. It is therefore possible that the effects of cultural diversity in terms of the distribution of foreigners matter. So it is possible that diversity within a group matters but that this effect disappears because of the rough classification of migrants' origins.

The question arises as to which regions benefit an advantage from polarization. The answer is easy - every region would gain from polarization. The logic behind this result is that we estimate fixed effects models. The fixed effects model examines a change in the polarization index within a region and this identifies the parameter estimate. From a policy perspective this result seems to be unreasonable, because there are only few reasons why a region should be interested in dominant groups of foreigners (among the foreigners). Where cultural diversity has negative effects these may decrease, the more similar the foreigners' cultural backgrounds are. An advantage of homogeneity among migrants could be interpreted as a factor that can reduce ethnic conflict. From the natives' perspective the presence of dominant groups might also reduce integration costs, for example as a result of an easier reduction of language barriers, provision of migrant-specific public goods, or it might reduce the fear of contact and thus facilitate the integration of migrants into the labour market. A tendency towards dominant groups could also be a result of migrants' network with their respective home countries and indicates that they attract further migrants. This attraction of new migrants can be seen as an advantage, however.

In the literature review various ways in which cultural diversity matters are outlined. One of the branches of literature focuses on innovation abilities (Niebuhr 2010, Ozgen et al. 2011). We therefore tested various models that take the innovation issue into account. First, we added the proportion of high-skilled migrants to the model. Second,

we interacted this proportion with the human capital measure. In this case an increase in the proportion of foreign-born high-skilled workers might strengthen human capital effects. Third, we focused on the diversity of foreign-born human capital. In all three cases we obtained insignificant results, even after controlling for the endogeneity of migrants. One reason for this unexpected result could be that the proportion of foreigners in the total regional stock of human capital is relatively small so the individual impact of this group of migrants vanishes with regard to average regional income.

To summarize, immigration does not reduce GDP per capita on average. However, a regional macro-model of this type is not able to separate effects for different groups within the labour force. It is still possible that a sub-group of the natives or former migrants have disadvantages when new migrants enter the regional labour market. The impact of immigration on specific groups of the labour market can be found in Nathan (2011) and Suedekum et al. (2009) for the UK and Germany, respectively. Both studies show negative effects when foreigners and natives compete for specific jobs. Given our data and modelling approach we cannot separate effects for sub-groups of natives and migrants.

As mentioned in the introduction, demographic change will affect regional economic performance in the future. In particular labour shortages may occur because of a shrinking society. In order to countervail these labour shortages, attracting migrants seems to be a reasonable aim from a policy perspective. If there are no gains or losses due to immigration, an increase in the stock of non-natives would not affect GDP per capita in our model. This does not mean that immigration does not affect economic outcomes, because the immigrants contribute to the social security systems when they work, relaxing problems caused by demographic change, and reduce potential labour shortages. We find evidence that regional income increases as a result of immigration, which leads us to conclude that there are positive income effects on average. When looking at migration within the EU, it is also necessary to consider the effects that may occur in the regions of origin due to the outflows. Depending on the labour market status of migrants before they leave, regional income might increase or decline after they depart. Then, an EU-wide policy should mainly aim to encourage people to migrate when the migrants' region of origin can be expected to gain from the outflow. This reduces regional disparities to a certain extent. However, our findings also confirm that the costs of integration decrease in the presence of dominant groups of foreigners.

7 Conclusion

This paper investigates the impact of a culturally diverse population on regional income for EU regions including parts of the European New Member States. We adopt a neoclassical approach inspired by the Mankiw-Romer-Weil (1992) model and augment this model by allowing labour heterogeneity with respect to the cultural background as the approach of Ottaviano and Peri (2005) suggests. The research question is whether a culturally diverse labour force has positive or negative effects on regional GDP per capita. While controlling for regional and time fixed effects, our estimation results suggest that per capita GDP increases when a region becomes more culturally diverse in two respects. First, we find evidence that an increase in the number of foreigners raises regional GDP per capita. Second, our estimates suggest that the presence of dominant groups reduces the costs of integration and thus promotes income growth. Obviously, both channels capture positive and negative effects of cultural diversity. The positive impact of dominant groups might be due to a rough classification of the cultural backgrounds. It is argued that cultural similarities exist within such a rough classification which therefore reduce the costs of integration or the costs of an efficient provision of migrant-specific public goods.

In the discussion surrounding demographic change, immigration is seen as a way to countervail labour shortages that may occur in the future. Our results suggest that there are additional gains from immigration due to migrant-specific skills that increase productivity and thus income.

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