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419/2012

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AUSTRIAN INSTITUTE OF ECONOMIC RESEARCH

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WIFO Working Papers, No. 419
January 2012

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2012/012/W/0

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Migration and Regional Convergence in the European Union

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Abstract

We offer an empirical, econometric analysis of the impact of migration on the EU27's NUTS2 regions in the period 2000-2007. While our results indicate that migration had no statistical impact on regional unemployment in the EU it had a significant impact on both GDP per capita and productivity. The coefficients suggest that a 1 percentage point increase in immigration to immigration regions increased GDP per capita by about 0.02 per cent and productivity by about 0.03 per cent. For emigration regions an increase in the emigration rate leads to a reduction of 0.03 per cent in GDP per capita and 0.02 per cent in productivity. Since immigration regions are also often regions with above average GDP and productivity while emigration regions in Europe practically all have below average GDP, migration seems to induce divergence rather than convergence.

Key-Words: Migration, Convergence, Unemployment

JEL-Codes: O15, O18, R23, R11

1. Introduction

European migration trends in the last decade have been marked by a number of spectacular changes. In particular, in the course of the recent enlargement immigration to some EU15 countries from the EU10 has become remarkable[1]. Immigration from EU10 to the UK is estimated to have accounted for some 560,000 persons in 2004-2006 (Lemos and Portes 2008) and a number of the EU15 countries which still were emigration countries in the beginning of the 1990's such as Spain or Ireland also received substantial immigration from there. At the same time, since enlargement 2004/07 the EU also faces a major cohesion problem, manifesting itself in substantial income and unemployment differences which, however, show a clear trend to decline. This raises the question whether migration had an effect on unemployment and GDP per capita levels in the 2000s and whether it contributed to a reduction of regional disparities.

This question cannot be answered from the point of view of economic theory alone. According to standard textbook models migration may produce transitory employment, wage and GDP effects in highly developed open economies but no long run effects. In closed economies with rigid sector specializations also long run effects are possible (Borjas 1999) while in both open and closed economies a number of other factors (such as the structure of migrant flows in terms of human capital, the elasticities of substitution between natives and migrants of potentially different ages and human capital endowments, the price elasticity of labor demand, the speed of adjustment of the capital stock and the reaction of national wage setting institutions and many more) have been shown to have an impact on the sign of the long run as well as the short run effects of migration on labor markets and GDP per capita (see Borjas 2003; Ottaviano and Peri 2006 and Bentolila et al. 2008 for recent discussions of the impact of some of these variables).

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[1] We refer to the Central and Eastern European countries acceding to the EU in 2004/07 as the EU 10, EU 12 for all new member states 2004/07 and EU15 for countries that were EU member states already before 2004.

The question of the effects of migration on the labor market and GDP per capita is thus essentially an empirical one, with the empirical literature on employment and income effects of migration (which in contrast to numerous studies covering the US is not too rich for Europe) following a number of different strands. One of these makes projections on the effects of migration on employment and output in simulations with Computable General Equilibrium (CGE) Models. These simulations assume competition between migrants and native labor, distinguish between skill groups, know mobility between regions and industries as a reaction to immigration, permit a change in sector composition and include demand effects from the larger household sector including the migrants. Those models project small unemployment and wage effects, which can be balanced by demand effects (see: Boeri and Brücker 2005; D´Amuri et al. 2010; Barrell et al. 2010 for model simulations on the effects of migration from Eastern Europe in selected European countries).

The second type of literature draws on empirically observed developments in migration, employment and wage changes and (econometrically) estimates the statistical relationships between migration and unemployment, wages or output growth. These studies often focus on regional, industrial or individual level data of one country and often come to the conclusion that immigration has no or only a very small significant effect on unemployment, but affects output growth positively (see: Longhi et al. 2006 for a recent meta study and Dustmann et al. 2005; Lemos and Portes 2008; Bonin 2005 on labor market effects in the UK and Germany; Mas et al. 2008; Huber et al. 2010 and Robinson et al. 2010 for effects on GDP per capita).

A part of this second strand in the literature estimates the growth effects of migration in convergence models (surveyed by Etzo 2008 and Ozgen 2010) in the spirit of Barro and Sala-i-Martin (2004). These contributions typically find that the effect of net migration on per capita income growth is positive, but small and that it affects the convergence coefficient positively. It is often argued that a larger pool of labor is likely to have a positive effect on productivity if the quality of migrant labor improves the quality of the workforce in the receiving country and that migrant labor has the potential to enhance

technology adoption and adaptation, either by directly contributing to innovation (Mattoo et al, 2008), or by facilitating knowledge spillovers (Moen, 2005).

Most of these studies (all except for Huber et al. 2010 and Robinson et al. 2010) focus on particular countries and/or specific labor market segments. However, there is very little literature which assesses the effects of migration from a general European perspective, particularly when it comes to analyzing the impact of migration on the declared policy objectives of the EU (such as cohesion and competitiveness). This study therefore offers an empirical, econometric analysis of the impact of migration on the EU27's NUTS2 regions in the period 2000-2007. In particular, we analyze whether migration affects unemployment, GDP per capita growth and productivity growth. In accordance with the literature we find no significant impact of migration on unemployment. Migration, however, has a positive effect on GDP per capita growth as well as on productivity growth. Immigration regions experience a 0.02 per cent increase in GDP per capita and a 0.03 per cent increase in productivity when the net immigration rate increases by 1 percentage point. Emigration regions loose 0.03 per cent of GDP per capita and 0.02 per cent of productivity by a 1 percentage point increase in emigration. Thus we conclude that migration, since influencing productivity, evidently changes the structure of skills. It therefore has a positive effect on the competitiveness of – generally richer - immigration regions, but a negative one on emigration regions. Migration therefore does not promote income convergence.

The rest of this study is organized as follows: In section 2 we describe the theoretical effects of migration and review the results of the empirical literature. Section 3 presents the model specification and section 4 discusses data issues. Section 5 shows some empirical facts. Section 6 presents the results of our estimations and section 7 concludes.

2. Migration in theory and in the empirical literature

Our theoretical starting point is the theory relating to the labor market impact of migration. In this, migration is assumed to change the overall labor supply and - if representing a particular skill group, - the skill structure in the destination (and sending) region. In an economy where capital is fixed and which has a small product range and

little exposure to world trade, migration will lead to long run employment and wage effects, since such an economy has no flexibility to change its output mix (Borjas 1999; Card 2001). By contrast a multi-product open economy should not see such long run effects, since it can adjust its product structure. An industry which uses a specific skill intensively will face lower wage costs if immigration occurs in that skill group. At given world prices, this industry will become more profitable, attracting more firms until the original wage level is restored. Leamer and Levinsohn (1995) call this "long run factor price insensitivity" of open economies to immigration. Nevertheless, in the short run, wages in skill groups which experience an inflow of additional labor due to immigration may be depressed (Dustmann et al. 2005 and 2008).

Dustmann et al. (2008) argue that immigration of a particular skill group used by an industry may also lead to the change in the technology used in that industry. An increase of unskilled workers might thus promote the use of labor intensive production methods, for example agriculture may produce more labor intensive crops if unskilled labor is plentiful. Referring to the literature, Dustmann et al. (2008) state that about two thirds of labor market adjustments are affected by technological change. In summary, theory does not propose a single outcome of migration. Unemployment and wage effects may but must not occur; they can be both transitive as well as permanent.

Considering the output effects of migration, one has to note that in the short run, migration reduces the capital to labor ratio in a specific sector or in the economy in general and thus makes labor less productive. However, since wage costs are lower, returns to capital increase. This increased profitability attracts international capital flows in open economies or increased internal investments in closed economies, which restores the capital to labor ratio and thus productivity. As labor and capital endowments have increased, the economy has settled on a higher output level (see: Barrell et al. 2010). Ottaviano and Peri (2006) estimate that capital mobility is sufficient to restore 10 per cent of the original capital to labor ratio each year.

Empirical econometric studies mostly fail to find any significant impact of migration on labor market aggregates. In a review of this literature, Longhi et al. (2006) conclude that on average a 1 per cent increase of immigration reduces native employment by a

negligible 0.02 per cent, the impact on existing migrants being slightly higher. In Europe the effect on employment is higher, in the US this applies to the effect on wages. Jean and Jiménez (2007) found for OECD countries, that immigration has only transitory effects on unemployment. Rigid labor market policies and anti-competitive product market policies would increase the duration of unemployment which Angrist and Kugler (2003) also found, specifically for Western European countries.

Due to the long experience of immigration and the recent wave of migrants from the EU-10, immigration into the UK has been one of the most assessed movements in recent years. Similarly, for Germany which has seen important immigration in the 1970s and again since the early 1990s, migration effects were assessed. Dustmann et al. (2005); Lemos and Portes (2008) and Bonin (2005) are prominent representatives in this field. They all conclude that immigration had no adverse effect on aggregate unemployment but highlight the potential impact of migration on the distribution of income, by dividing the labor market into different skill and/or occupational groups as well as differentiating by age and gender at different regional aggregation levels. Evidently, this is the preferred design for empirical studies since immigrants typically compete with a specific labor market segment. Dustman et al. (2005) and Lemos and Portes (2008) find a small negative effect on unemployment of semi-skilled, young and old-age employed. Bonin (2005) finds that immigration has resulted in increased wage pressures for workers with short and very long work experience, but has not increased unemployment. Methodologically, Lemos and Portes (2008) argue that immigration effects should not be analyzed on a too low regional disaggregation level since outmigration or commuting might distort the results while Dustmann and al. (2005) emphasize that the analysis of immigration effects requires a fixed effects IV estimation to account for endogeneity of migration (since low unemployment/high wage regions attract immigration) and has to consider an appropriate set of control variables. While there is substantial country evidence of the effects of migration on unemployment and wages, to date there is only very little literature that focuses on this issue from a European perspective.

A number of recent studies also focus on the impact of migration on productivity and GDP per capita growth (for example Mas et al. 2008; Paserman 2008; Huber et al. 2010;

Robinson et al. 2010). In this literature it is often argued that a larger pool of labor is likely to have a positive effect on productivity if the quality of migrant labor improves the quality of the workforce, and that the different skills that migrant labor may have, has the potential to enhance technology adoption and adaptation, either by directly contributing to innovation (Mattoo et al, 2008), or by facilitating knowledge spillovers (Moen, 2005). A part of these studies assesses the impact of migration on the productivity of different industries or within the manufacturing sector (Quispe-Agnoli and Zavodny 2002 for the US; Mas et al. 2008 for the UK and Spain). The results suggest that the experience is different across countries and industries. Furthermore, the skill level of immigrants is an important factor. Quispe-Agnoli and Zavodny (2002) and Mas et al. (2008) found that immigration had a negative effect on productivity in the US and Spain, which mirrors the fact of low skill migration in the US and Spain. In contrast, Mas et al. (2008) find a small positive impact of immigration on productivity in the UK. For European industries, Huber et al. (2010) found a positive productivity impact contingent on the skill level. While these studies permit to understand the forces behind different productivity and output effects of migration in single countries, an assessment for EU regions in general remains limited due to the poor reliability of migration data by skill groups.

The effects of migration on income growth have also been estimated in convergence models, following the original study of Barro and Sala-i-Martin (2004). Ezgo (2008) and Ozgen et al. (2010) provide surveys of this empirical literature and Niebuhr et al. (2009) a recent application for Germany. While Barro and Sala-i-Martin (2004) propose a negative effect of migration on per capita income growth, Ozgen et al. (2010) in their meta-study conclude that empirical studies in general propose a positive but small effect with a one percentage point increase of migration rates increasing the per capita GDP growth rate by about 0.1 percentage points. Shioji (2001) argues that migration may lead to two effects working in an opposite direction. On the one hand the so called quantity effect, which refers to the increase in population size, works to reduce growth and foster convergence, on the other hand the so called composition effect, which refers to the human capital composition of migrants, can affect the growth rate positively and could

lead to divergence. In summary, there is by now a relatively large literature on the effects of migration on convergence within countries, which despite substantial variations in individual findings, suggests that migration is at most a minor factor contributing to convergence in GDP per capita.

3. Model specification

Given that migration flows within Europe have become important and the freedom of movement is a key feature of European integration, we are interested whether migration has had an impact on the convergence of unemployment, competitiveness and per capita income. We think that, despite a somewhat more difficult data situation at the European level than for national case studies, it is highly important to address these issues from a European perspective given that reducing unemployment and increasing growth and productivity are all declared objectives of EU cohesion policy.

Our empirical analysis will be based on net migration data (international and internal migration) for the NUTS II level regions of EU member states for the period 2000-2007. We focus on a convergence specification and start from three central models :

$$\ln\left[\frac{U_{i,t}}{U_{i,t-1}}\right] = \alpha_{1,i} + \delta_{1,t} - \beta_1 \ln U_{i,t-1} + \gamma_1 NETMIG_{i,t} + \theta X_{i,t} + \varepsilon_{1,i,t} \quad (1)$$

$$\ln\left[\frac{GDPPC_{i,t}}{GDPPC_{i,t-1}}\right] = \alpha_{2,i} + \delta_{2,t} - \beta_2 \ln GDPPC_{i,t-1} + \gamma_2 NETMIG_{i,t} + \varphi Z_{i,t} + \varepsilon_{2,i,t} \quad (2)$$

$$\ln\left[\frac{PROD_{i,t}}{PROD_{i,t-1}}\right] = \alpha_{3,i} + \delta_{3,t} - \beta_3 \ln PROD_{i,t-1} + \gamma_3 NETMIG_{i,t} + \omega W_{i,t} + \varepsilon_{3,i,t} \quad (3)$$

Equation (1) relates regional unemployment rate growth to the lagged unemployment rate ($U_{i,t}$) and indicators on net migration (e.g. the net migration rate or its subcategories international and internal migration) as well as a number of control variables $X_{i,t}$. Equation (2) relates GDP per capitagrowth (at PPS) to lagged GDP per capita levels ($GDPPC_{i,t}$) as well as our measures of net migration and a set of control variables $Z_{i,t}$, while equation (3) relates productivity growth in a region (measured as real gross value

added per employed) to lagged productivity ($PROD_{i,t}$), migration indicators and a set of control variables $W_{i,t}$.

We transform equations (1)-(3) and estimate the following equations for each of the dependent variables (log unemployment rate, log GDP per capita and log productivity):

$$\ln U_{i,t} = \alpha_{1,i} + \delta_{1,t} + (1-\beta_1)\ln U_{i,t-1} + \gamma_1 NETMIG_{i,t} + \theta X_{i,t} + \varepsilon_{1,i,t} \quad (4)$$

$$lnGDPPC_{i,t} = \alpha_{2,i} + \delta_{2,t} + (1-\beta_2)\ln GDPPC_{i,t-1} + \gamma_2 NETMIG_{i,t} + \varphi Z_{i,t} + \varepsilon_{2,i,t} \quad (5)$$

$$lnPROD_{i,t-T} = \alpha_{3,i} + \delta_{3,t} + (1-\beta_3)\ln PROD_{i,t-T} + \gamma_3 NETMIG_{i,t} + \omega W_{i,t} + \varepsilon_{3,i,t} \quad (6)$$

The $\alpha_{k,i}$ ($k\epsilon\{1,2,3\}$) are families of region specific intercept terms which are used to control for any unobserved time invariant regional characteristics (such as for instance amenities) that may impact on the rate of growth, $\delta_{k,t}$ are sets of time specific intercepts that control common time specific shocks (such as for instance common business cycle effects) to all regions, β_k, γ_k, and θ, φ and ω are coefficients to be estimated and $\varepsilon_{k,i,t}$ are stochastic (i.i.d.) error terms.

With respect to the unemployment model in Equation (4) this specification is similar to that used in the literature on the labor market effects of migration (e.g. Lemos and Portes 2008; Borjas 1999; Card 2001 and Dustman et al. 2005) where unemployment rates are related to migration and control variables. We, however, extend this by including the lagged unemployment rate. This will allow us, first of all, to also draw conclusions on whether our regions were convergent in unemployment in our observation period and, second of all, to test the impact of migration in equation (4) on unemployment. [2]

For the control variables we use different variables in each equation based on previous literature. In particular, with respect to the unemployment rate in equation (4) – as discussed in the data section below – our choice of control variables is based on the literature survey of the determinants of regional variations in unemployment rates by Elhorst (2003). In which he concludes that specifications explaining unemployment rates

[2] An alternative strategy to identify effects of migration is to use the skill level of migrants distinguishing between occupational groups or different education or work experience (see: Bonin 2005, Card 2001 and Borjas 2003). This approach is not open to us due to data constraints.

should include proxies for population growth in the region, wages, amenities, education structure and the sector structure of the economy. With respect to the GDP per capita in equation (5), we follow the literature on income convergence and include the population growth rate and investments as well as proxies for the education and age structure of the population and sector shares. For the productivity equation (6) we use the same variables as in the GDP per capita equation, but also use the employment rate to proxy for labor supply.

As widely discussed in the literature, estimation of equations (4)-(6) is associated with a number of problems. The first of these is endogeneity: Immigrants from abroad select regions of residence where they find the highest return, (i.e. regions with low unemployment and high income - Borjas 2001). This may result in a spurious positive impact of migration on the labor market due to reversed causality. The literature usually suggests solving this by instrumentation. The problem is to find appropriate instruments, with much of the literature using lagged migration rates or lags of population growth (e.g. Dustmann et al. 2005; Bonin 2005). In our case, since we are estimating a dynamic panel data model, we follow the suggestion of Blundell and Bond (1998), to use both the lagged levels and differences of all variables as instruments and apply system GMM using a maximum of three further lags of independent variables as instruments. This has the advantage that aside from controlling for the endogeneity of migration also the endogeneity of the lagged dependent variables as well as of other dependent endogenous variables can be controlled for.

A second problem is that international migration may induce internal migration flows in the recipient country. Thus assessing the unemployment impact over all regions of a country may result in a spurious positive impact of immigration on labor markets for this reason. This, however, is not relevant in the context of the present study since in all of our regressions internal migration of nationals is included in the measures of migration or as a separate dependent variable as recommended by Dustmann et al. 2005.

Finally, it is also important to select the right regional aggregation level to draw conclusions on migration effects. The region should represent a good approximation to a closed labor market, meaning that labor would only search for work within the region. If

the aggregation level is too low, one will have the situation that workers might move to surrounding regions if competing with migrants. With low-skilled work the closed labor market is commonly found at a more disaggregate geographical level since low paid workers cannot afford distant commuting. We look at the regional NUTS2 level. Since we also include all internal migrants in our regressions, the only form of mobility that could cause such bias in our application is commuting. We think, however, that given the size of NUTS2 regions this is not a major impediment to our analysis.

4. Data

To estimate our models we use data from the EUROSTAT Regio Database as well as data from Cambridge econometrics for the years 2000-2007. In particular from these data sources we use the unemployment rate and GDP per inhabitant at PPS from the Eurostat data base and labor productivity, which we proxy by real GDP per employed, from the Cambridge Econometrics database (see Annex). Aside from these dependent variables EUROSTAT data also provides information on a number of migration indicators. These are the migration rate (which is computed as the difference between total population growth minus the natural population growth i.e. live births minus deaths), and net population moves due to internal migration (calculated from data on arrivals and departures due to internal migration) and the net migration rate from abroad, which is calculated as the difference between the migration rate and the population moves due to internal migration. Serious inconsistencies in data do not permit to use more detailed migration indicators.

Finally, EUROSTAT data is also used as information source for our control variables. Here the literature of regional unemployment disparities has suggested a large number of different factors that may have an impact on regional unemployment. Synthesizing this literature Elhorst (2003) suggests a variety of variables, which in general have a significant impact on regional unemployment. Of these it is possible to obtain from Eurostat sources the natural population growth, the share of young population (i.e. the share of those aged below 25 in total population), the share of low educated in the labor force (i.e. the share of employed ISCED 2 or lower education in total employment), data

on compensation per employee as well as indicators on regional structural change, specialisation and sector structure, which are the turbulence index[3], Herfindahl index[4] and the share of agricultural employment. Furthermore, the literature on growth econometrics (see Durlauf et al. 2005) has identified a large set of potential growth regressors. Of these variables we include the investment share (taken from Cambridge econometrics), natural population growth, the share of young population, the high educated share and the agricultural share.[5]

The extracted data set still showed some missing data problems. In particular we were unable to secure data on migration to the UK and Bulgaria and were also unable to obtain any data on internal migration for Germany, France, Greece, Ireland, Portugal and the UK. We therefore have to exclude the UK and Bulgaria completely from our analysis while also Germany, France, Greece, Ireland and Portugal are missing from specifications in which internal and external migration is analyzed separately. In addition since for Denmark subnational NUTS2 regions were defined only in 2007, we miss all regional information before 2007. Therefore we use national Danish data throughout. Finally we also missed data for 7 regions in Germany for two years. For these regions we extra-(or intra-)polate the relevant information based on the information available from higher tier (NUTS1) regions and a time trend.

Given the data situation we can therefore derive a consistent data set of our dependent as well as independent variables which allows us to analyze the impact of migration on regional convergence of unemployment rates GDP per capita and productivity 2000 to 2007 for all EU27 countries with the exception of Bulgaria and the UK for this time period. When, however, extending this analysis to account for potential differences in the effects of internal or external migration our data becomes more restricted since we have to exclude Germany, France, Greece, Ireland, Portugal and the UK.

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[3] This is given as the sum of absolute changes in shares over sectors of employment as compared to the previous year on a crude sector breakdown which differentiates between employment in agriculture, manufacturing, construction, trade and restaurants and transport (as one group), financial services and real estate, and non-market services.

[4] This is based on the same sector breakdown as the turbulence index.

[5] Note that we exclude the French overseas territories as well as Ceuta and Melilla from the analysis

{Figure 1: around here}

5. Some Empirical Facts

Figure 1 uses these data to show the development of regional disparities in the EU27 by displaying the coefficient of variation for regional per capita income, productivity and the unemployment rates. It highlights the tendencies of convergence of these variables in our observation period. Evidently, disparities in unemployment among EU regions are by far the largest, followed by disparities in productivity and per capita income. Per capita income as well as productivity disparities reduced over the whole period considered, although to a modest extent. Thus there is a steady process of income and productivity convergence taking place in the EU27 since 2000. Unemployment rates have converged over the whole period to a major extent, despite an apparent cyclical pattern which reveals a peak in 2002 and a new increase in 2007.

{Figure 2: Around here}

Figure 2 provides evidence on the extent of international migration in the EU by looking at the total net migration rate by country[6]. We see a significant variation in net migration. Leaving aside the extreme cases of Malta and Cyprus that received exceptionally high immigration – they are small islands and may have attracted residents due to their attractiveness as a second domicile and as a location for headquarters - we observe that Spain, Luxemburg, Ireland, Italy and Portugal show the highest net migration rates. In the time period 2004 to 2007 between 1.9-5.3 per cent of the

[6] Since population data from EUROSTAT disaccords with national sources in a number of instances we checked for consistency of our migration data and corrected for discrepancies using national sources in the critical cases of Poland, Slovakia and the Czech Republic. For the other countries EUROSTAT data is consistent with national sources and the facts reported in the literature (see e.g. Facchini, Mayda 2008).

population immigrated to these countries. Immigration rates have also been rather persistent. All immigration countries (with the exception of the Netherlands) in the period 2000 to 2003 were also immigration countries in the period 2004 to 2007 and also all emigration countries in the earlier period remained so later. Only the Netherlands changed from an immigration to an emigration country between the pre- and post-enlargement periods considered here. Finally, figure 2 also shows, that, in contrast to the perception in the public debate, also the majority of the EU12 countries (Czech Republic, Cyprus, Estonia, Hungary, Malta, Slovakia, Slovenia) are (and have been for the majority of the 2000's) net immigration countries. The only EU27 countries that are net emigration countries are Lithuania, Latvia, Poland and Romania and (since 2004) the Netherlands.

{Figure 3: Around here}

Looking at total net migration not at the country but at the regional level we see that within our countries a number of regions are net emigration regions. They comprise practically entire Romania, the major part of Poland, Latvia and Lithuania, the peripheral regions of Sweden and Finland, Southern Italy and Northern France (figure 3). Ireland, the South and North-Eastern part of Spain, the South-West and South of France as well as North and Central Italy, and Cyprus are heavy net-immigration areas.

{Figure 4: around here}

Figure 4 shows the changes in unemployment rates in EU regions over the period 2000-2007. We see an improvement in unemployment throughout the EU10. Exceptions are Hungary and some parts of Romania where unemployment rates increased. Also the Southern EU regions -- with the exception of Portugal -- showed a decline in unemployment. Furthermore, Eastern German regions, France and Italy showed a reduction or unaltered levels of unemployment. On the other hand, an increase of unemployment appears in regions that started from lower unemployment. They include

the South of Sweden, West Germany and Austria to Hungary, the South of Ireland and Portugal. Thus this is further evidence that unemployment levels have converged among EU regions. However, there seems to be no such clear pattern between migration and unemployment changes. We find both a decline and an increase of unemployment in immigrant regions, while the emigrant regions, which also mostly had high unemployment rates at the outset of the period, in general experienced a reduction in unemployment. The correlation between the net migration rate and changes in the unemployment rate over the period 2000 to 2007 is very weak with 0.12.

{Figure 5: Around here}

Figure 5 shows the development of GDP per capita. In general, the European periphery had the highest growth rates, which also suggests a process of convergence. The highest growth rates are registered both in emigration regions in Eastern Europe as well as in high immigration regions of Spain and Ireland. The immigration regions in the South of France and the North of Italy, by contrast, show stagnating per capita income. Yet, the correlation between the net migration rate and GDP per capita growth (productivity) is 0.22 (0.27) for the period 2000 to 2007.

6. Results

6.1 Results for Convergence in Unemployment

Table 1 presents the results of our estimates for 4 different specifications for the unemployment rate equation. In the first of these (reported in the first column) we estimate equation (4). In column two we expand this baseline specification by including measures of net internal and external migration to focus on potential differences in effects of internal and external migrants.[7] We do this because external migrants moving

[7] As pointed out above, here, due to data constraints, we have to exclude Germany, France, Greece, Ireland, Portugal and Bulgaria and the UK. This results in a drop in the number of observations.

to a region from abroad may differ from internal migrants in terms of education structure and in addition may often face problems of transferring their skills across countries on account of differences in the education system or also simply because of language problems. Internal migrants that move place of residence within a country only, by contrast, are less likely to suffer from such problems of skill-transfer. This implies that immigration from abroad may not lead to the same results as migration within a country even when the education structure of both groups of migrants is similar. Finally, in columns (3) and (4) we focus on potential asymmetries of the impact among net emigration and net immigrations region as defined in figure 4 by restricting our sample to either immigration (column 3) or emigration (column 4) regions only.

In each of these regressions we consider the net migration rates, compensation per employee and lagged unemployment rate as endogenous variables and instrument them by their second and higher lags allowing for a maximum of two additional lags. All other variables as well as the year dummy variables, the coefficients of which are not reported in this table, are considered as exogenous and – following the suggestions by Roodman (2008) - are included as iv-style instruments in the regression. The bottom rows of these tables report the probability values of the Hansen J test to check for the validity of instruments and the Arellano-Bond tests for both first and second order serial autocorrelation in errors, to check for the validity of our specification. While first order serial autocorrelation is expected in our model, a rejection of the Arellano-Bond test for second order correlation would suggest model misspecification. A rejection of the Hanson J-test would indicate the use of invalid instruments. As can be seen from the table, we cannot reject the null hypothesis of valid instruments at the 10% level in all but one specification and at the 5% level in all specifications. Furthermore also the null hypothesis of second order autocorrelation according to the Arellano-Bond test cannot be rejected at the 10% level in most specifications, so that our models in general seem to be well specified.

{Table 1: Around here}

The regression results provide strong evidence of conditional convergence in unemployment rates among the European regions in the period 2000-2007. The coefficient on the lagged unemployment rate in table 1 ranges between 0.71 and 0.72 and differs significantly from both zero and unity in specifications where all regions are considered. This implies a convergence (beta) coefficient of between -0.28 and -0.29. The only results for which the estimated coefficients on the lagged unemployment rate are slightly lower (and thus convergence parameters somewhat higher) are those where we restrict the sample to either only immigration and emigration regions (columns 3 and 4). This is, however, due to the fact that in these specifications this parameter measures convergence among emigration and immigrations only.

Also the control variables included by and large accord with expectations and the previous literature (e.g. Elhorst 2003). A higher share of young persons, a higher compensation per employee, a higher long-term unemployment rate and stronger structural change at the sector level (i.e. a higher turbulence indicator) imply higher unemployment rates. The remaining demographic variables such as the natural population growth rate, as well as the share of high educated, by contrast, are mostly insignificant and, as shown by the statistically insignificant coefficient for the Herfindahl index, economically more diverse regions do not differ significantly from other regions in terms of unemployment.

When, however, focusing on the effects of migration on the unemployment rate, we find that it remains insignificant at all conventional levels of significance.[8] This insignificance also applies when we split our migration measure between internal and external migration as well as when splitting the sample into immigration and emigration regions. When separately considering internal and foreign migrants we find that both these groups of migrants have a statistically insignificant effect on the unemployment

[8] This result is highly robust across different specifications. In particular (in results not reported here) we also estimated the specification with other instrumental variable techniques as well as without controlling for endogeneity. The only significant results we were able to obtain, was a negative impact of migration on the unemployment rate in uninstrumented equations. This specification, however, suffers from a reverse causality problem (i.e. migrants moving to low unemployment region).

rate. Similarly differentiating between immigration and emigration regions we find that there are only few differences between the results for these two region types. In accordance with much of the empirical literature reviewed in section 2 therefore we find no statistically significant effect of migration on aggregate unemployment rates in the EU countries analyzed.[9]

The results, however, also point to some interesting differences in the determinants of unemployment rates in immigration and emigration regions. Comparing results for these two region types (in column 3 and 4 of table 1) we see that the positive impact of wages on unemployment rates in overall estimates, is due solely to this variable having a positive impact on unemployment rates in emigration regions, that only emigration regions profit from a better skill structure of their population in terms of lower unemployment and that a higher degree of specialization increases unemployment in emigration regions but remains insignificant in immigration regions. Although these results have to be interpreted with some care since the Hansen test for the validity of the over-identification restrictions performs poorly, indicating low instrument quality, when considering emigration regions, this suggests that there may be some important differences in the factors shaping unemployment in emigration regions, which are often low wage and high unemployment regions, and those in immigration regions, which often have high wages and low unemployment rates.

6.2 Results for GDP Per Capita Convergence

The results for the GDP per capita equation in which we control for endogeneity of the lagged dependent variable as well as investments and migration rates by following the same identification strategy as in the unemployment regression are reported in table 2. These also suggest conditional convergence of GDP per capita among the EU NUTS2 regions, although at a much lower rate than for unemployment. The estimated beta

[9] We also considered the potential impact of migration and youth and long term unemployment. These results indicated an insignificant impact of migration on youth unemployment but potentially a small but significant increase of long term unemployment. They, however, suffered low test statistics for the instrument validity, so that we do not report them here.

coefficient here is around -0.04 to -0.07 (but significantly differently from zero) when considering all regions. In accordance with the vast majority of the literature, investments have a significant positive impact on GDP per capita, while natural population growth has no significant impact. In addition, in aggregate as well as in immigration regions a low share of agriculture and a high share of highly skilled persons are also conducive of high GDP per capita growth.

From the point of view of the objectives of this paper, however, more important is that migration even after controlling for endogeneity has a positive impact on the GDP per capita in the receiving region.[10] Here the point estimates of the coefficient suggest that an increase in the migration rate by 1 percentage point increases GDP per capita at purchasing power by 0.02 per cent. This thus corroborates the conclusion of much of the literature (see Ozgen et al, 2010) that on average migration has a weakly positive effect on average GDP per capita growth. In addition, the second column of table 2 suggests that this positive effect of migrants on GDP per capita is due primarily to a positive effect of migrants from abroad. While migrants from the same country have an insignificant effect on GDP per capita, the significant effect for foreign migrants suggests that a 1 percentage point increase in the share of migrants from abroad to a region increases GDP per capita by 0.02 per cent.

{Table 2: Around Here}

Furthermore, when splitting the sample into immigration and emigration regions we find that immigration has a positive impact in the first case, while emigration has a negative impact on the later regions. According to the coefficient estimates a 1 percentage point increase in the net immigration rate of immigration regions leads to a 0.02 per cent increase in GDP per capita. By contrast, in emigration regions an equivalent increase in the emigration rate (which in emigration regions is equivalent to a further reduction of

[10] Again this result is highly robust across specifications. In particular (in results not reported here) we also estimated the specification with other instrumental variable techniques and without controlling for endogeneity. In all of the equations the positive co-efficient was found.

the already negative net immigration rate) reduces GDP per capita by 0.03 per cent. This therefore suggests that migration tends to increase regional disparities, since emigration regions are often also regions with a low GDP per capita while immigration regions have a higher GDP per capita.

6.3 Results for Productivity Convergence

These effects of migration on GDP per capita can be considered as a combined effect of both supply and demand side effects of migration on GDP. Supply side effects in this respect may result from productivity changes due to changes in the skill structure and demand side effects from additional demand of migrants. In order to disentangle these effects and to provide some evidence on the impact of migration on the competitiveness of regions we therefore also estimated the impact of migration on productivity (see table 3 for results). In this regression we controlled for investments and the employment rate, which we instrument for in the same way as for GDP per capita to account for their potential endogeneity as well as for the share of highly qualified and the agricultural share in a region, which are considered to be exogenous variables.

The results once more point to strong tendencies of productivity convergence among the EU NUTS2 regions in our observation period. The estimated coefficient on the lagged productivity level ranges between 0.79 and 0.88, in all regressions focusing on the full sample of regions. This implies a beta coefficient of -0.21 to -0.12. Similarly, again in accordance with results for GDP per capita, a high investment rate and a high share of highly educated residents and a low share of agricultural employment increase regional productivity in all regions except for emigration regions.

{Table 3: Around Here}

Finally, we find that migration, after controlling for endogeneity, has a positive impact on productivity in the receiving region. The point estimates of the coefficient indicate a similar impact of migration on productivity growth as in the case of GDP per capita growth and thus indicate that most of the increase in GDP per capita from migration is

due to supply side effect resulting from productivity gains. An increase in the migration rate by 1 percentage point increases labor productivity by 0.02 per cent on average. Once more this is primarily due to a significant positive productivity impact of migration from abroad, while the impact of internal migration remains statistically insignificant. In addition, a further division of the sample into emigration and immigration regions suggests that emigration (i.e. more negative net-immigration) leads to a reduction in productivity in emigration regions while immigration increases productivity in immigration regions. This thus corroborates our previous finding that emigration regions are likely to lose in terms of GDP per capita and productivity from the emigration of high skilled migrants while immigration regions gain skills through migration and thus experience gains in both productivity and GDP per capita.

7. Conclusions

Given that immigration is faced by almost all European countries and that it can potentially affect unemployment and income levels as well as the speed of convergence in living standards among regions, which are all major concerns of cohesion policy, this study conducted an empirical, econometric analysis covering all EU27 regions in the 2000-2007 period, which is characterized by important changes in the relevant indicators. We analyze to what extent migration affects unemployment, GDP per capita growth and productivity growth, which we consider an indicator for competitiveness of a region. In addition, we estimate the effects of migration in the case of immigration and emigration regions and internal and external migration.

In our econometric analysis, we cannot find a significant impact of migration on the regional unemployment rate. Migration, however, has a significantly positive impact on both GDP per capita and productivity growth in immigration regions. The coefficients suggest that a 1 percentage point increase in immigration to immigration regions increases GDP per capita by 0.02 per cent and labor productivity by about 0.03 per cent. For emigration regions point estimates indicate that a similar increase in the emigration rate leads to a reduction of 0.03 per cent in GDP and 0.02 per cent in productivity,

Finally, our results highlight the differential impacts of different migrants. The significant effect of overall migration arises primarily from foreign migrants. Both for GDP per capita and productivity, we find that international migration is responsible for the growth increasing effect of immigration. Although severe data constraints do not permit us to analyze the impact of different skill groups of migrants, our results thus provide indirect evidence that migration can be viewed as a transfer of human capital to immigration regions and thus increases regional growth and productivity. Since immigration regions are, however, also often regions with above average GDP and productivity while emigration regions in Europe practically all have below average GDP, migration also seems to induce regional divergence rather than convergence.

Acknowledgements

Research for this paper has been undertaken as part of the project "The Impact of the Single Market" commissioned by the European Commission, DG Regio. We thank the participants of the WIFO Workshop Regional Development, Integration and Mobility in the European Union in Vienna, the EU Real/CRENOS Workshop on Economic Development in Peripheral Regions in Alghero and of the ERSA conference in Barcelona for helpful comments. All mistakes remain in the responsibility of the authors

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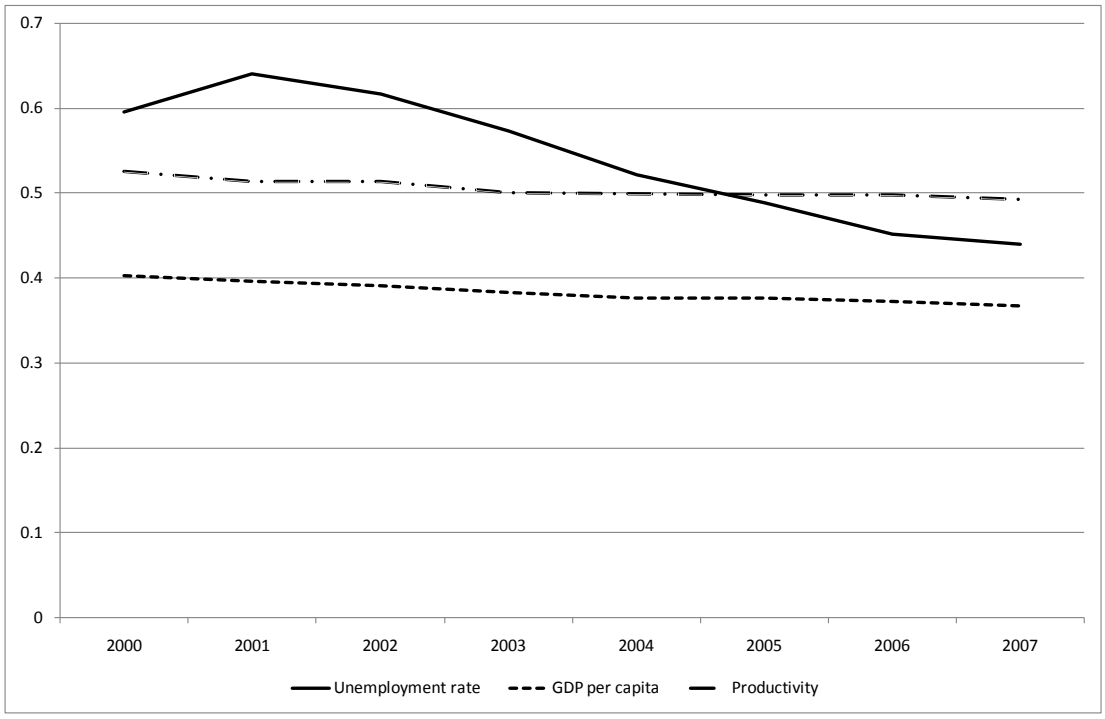
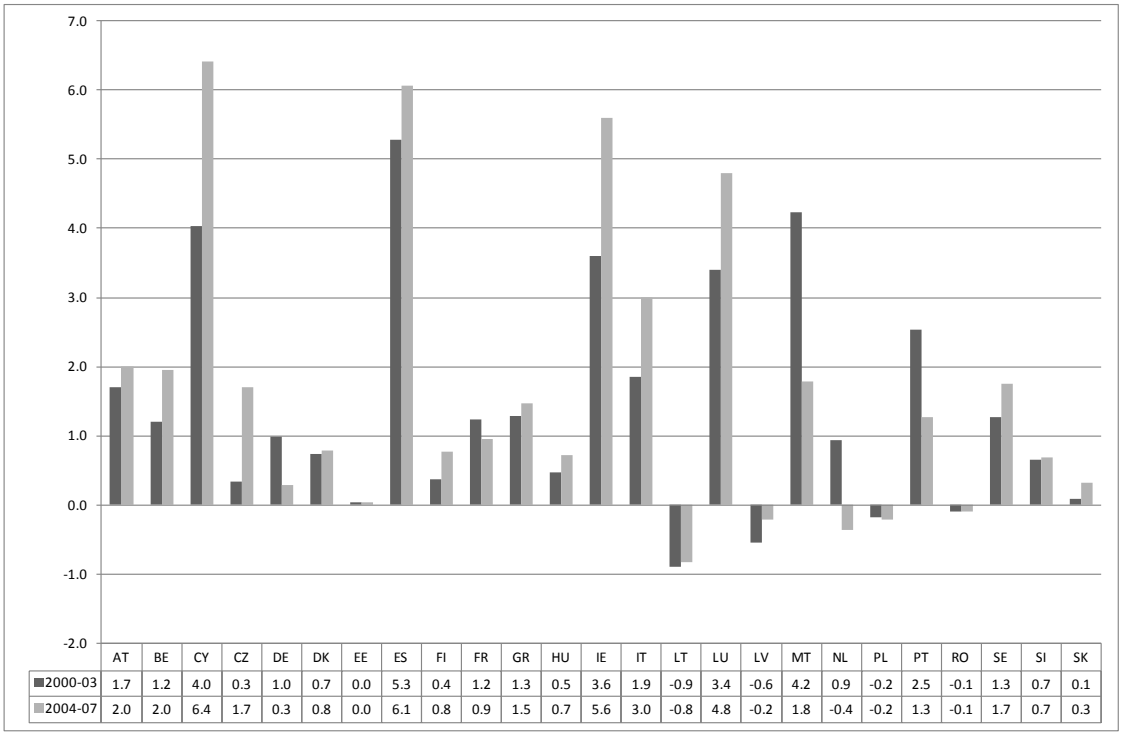
Figure 1: Development of Regional Disparities in the EU27: Coefficient of Variation of Unemployment, GDP Per Capita and Productivity



Source: EUROSTAT, own calculations.

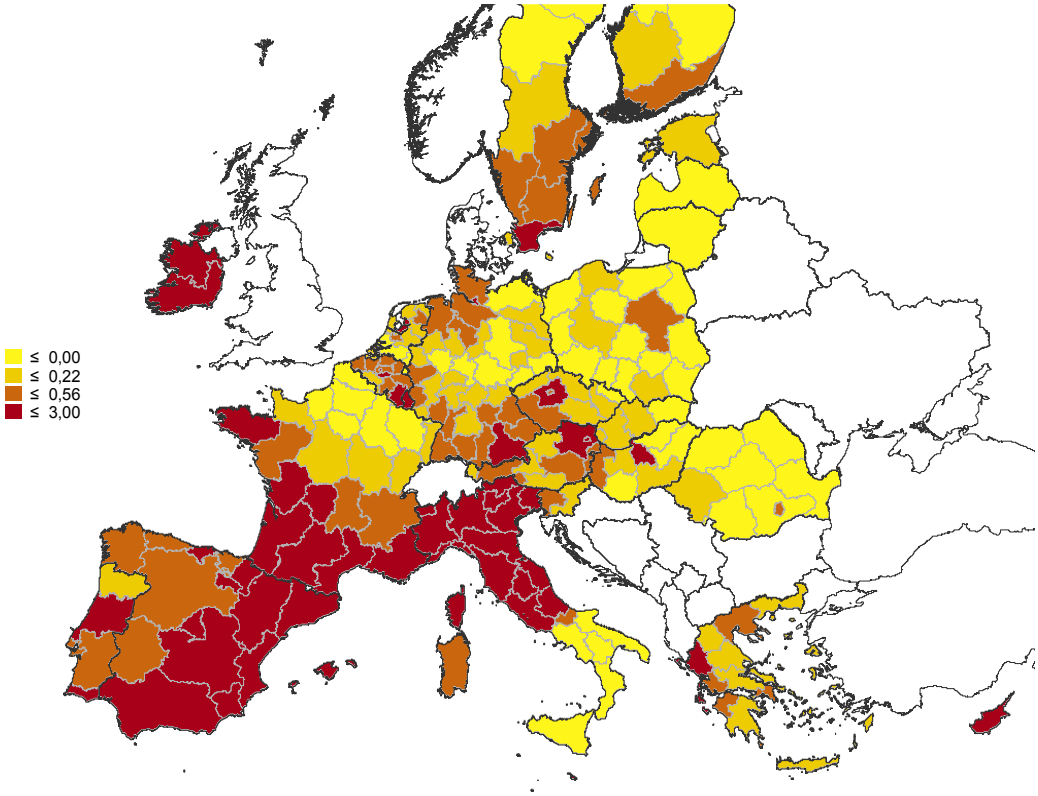
Figure 2: Total Net Migration in Per Cent of Total Population by Country and Selected time periods



	AT	BE	CY	CZ	DE	DK	EE	ES	FI	FR	GR	HU	IE	IT	LT	LU	LV	MT	NL	PL	PT	RO	SE	SI	SK
2000-03	1.7	1.2	4.0	0.3	1.0	0.7	0.0	5.3	0.4	1.2	1.3	0.5	3.6	1.9	-0.9	3.4	-0.6	4.2	0.9	-0.2	2.5	-0.1	1.3	0.7	0.1
2004-07	2.0	2.0	6.4	1.7	0.3	0.8	0.0	6.1	0.8	0.9	1.5	0.7	5.6	3.0	-0.8	4.8	-0.2	1.8	-0.4	-0.2	1.3	-0.1	1.7	0.7	0.3

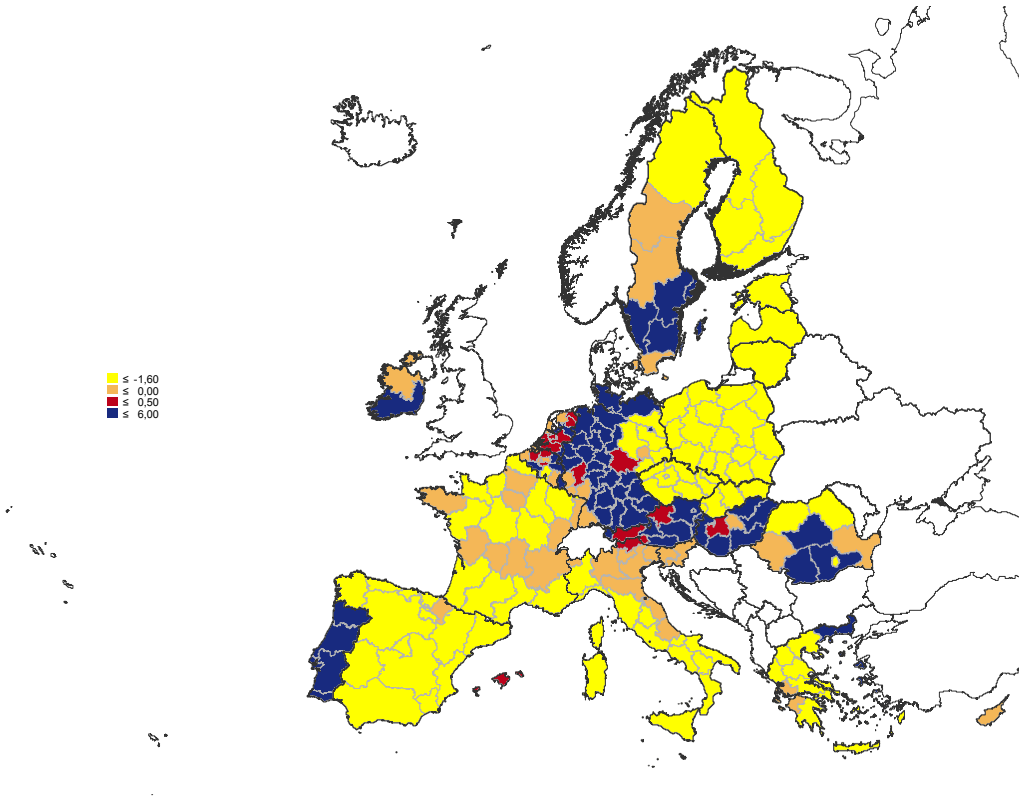
Source: EUROSTAT, own calculations, Note:Figure reports sum of absolute net migration across regions by year in per cent of total population.

Figure 3: Total Net Migration Share



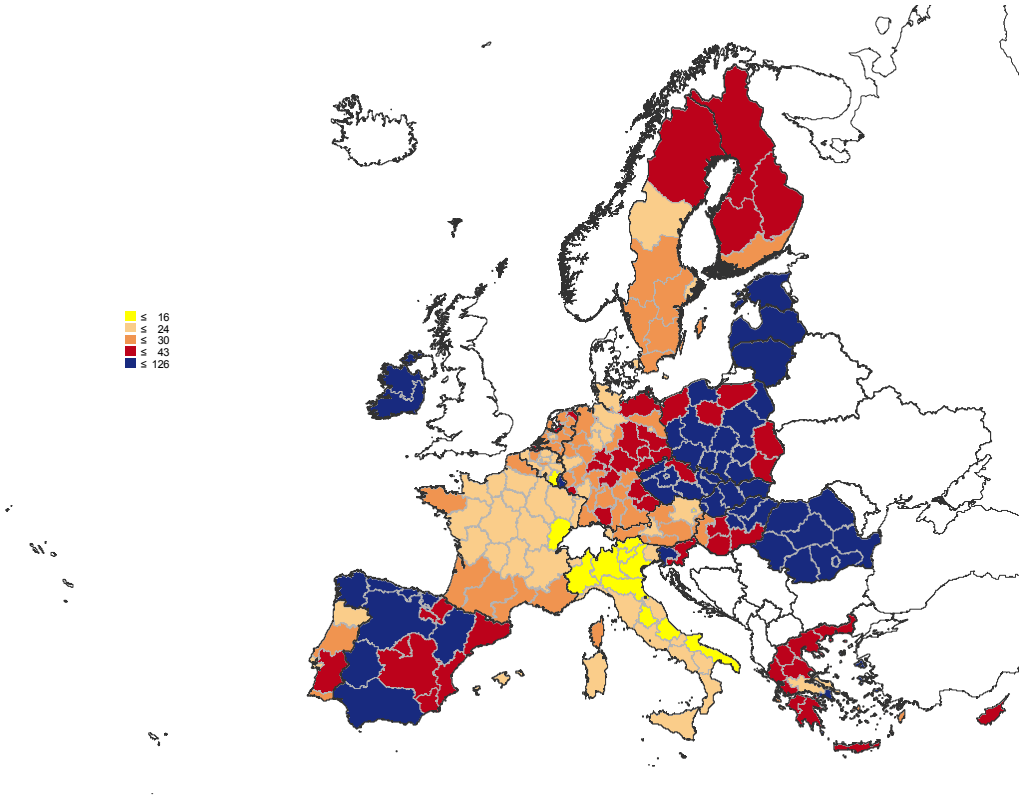
Source: EUROSTAT, own calculations. Note: Figure displays total immigration or emigration in the period 2000 to 2007 in % of population 2000

Figure 4: Changes in regional unemployment rate 2000-2007, in percentage points.



Source: EUROSTAT, own calculations.

Figure 5: GDP per capita growth 2000-2007, in %



Source: EUROSTAT, own calculations.

Table 1: Results for unemployment rates

	(1) Including all migrants	(2) separate internal and external migrants	(3) only immigration regions	(4) only emigration regions
ln(unemployment rate)$_{t-1}$	0.715***	0.711***	0.690***	0.551***
	(0.060)	(0.102)	(0.123)	(0.082)
Net immigration rate	0.016		-0.072	-0.187
	(0.084)		(0.061)	(0.118)
Net immigration rate from same country		-0.101		
		(0.072)		
Net immigration rate from abroad		0.106		
		(0.107)		
ln(compensation per employee)	0.122***	0.119**	0.034	0.327***
	(0.043)	(0.060)	(0.043)	(0.069)
Natural population growth	-37.605	-38.416	-19.569	-27.529
	(23.083)	(20.858)	(11.531)	(16.935)
ln(share of young population)	0.951***	1.103***	0.384*	2.802***
	(0.328)	(0.360)	(0.221)	(0.535)
ln(share of highly educated)	-0.013	-0.001	0.040	0.126**
	(0.026)	(0.044)	(0.043)	(0.060)
ln(share agriculture)	-0.003	-0.019	0.024	-0.009
	(0.014)	(0.028)	(0.023)	(0.027)
ln(turbulence index)	0.653***	0.389**	0.413	-0.264
	(0.298)	(0.184)	(0.556)	(0.186)
ln(herfindahl index)	-0.026	0.042	-0.087	0.081*
	(0.021)	(0.044)	(0.054)	(0.048)
ln(long term unemployment rate)	0.002***	0.003***	0.002**	0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Observations	1720	1080	1312	408
Number of groups	215	135	164	51
Instruments	33	34	33	33
Hansen J Statistic[a)]	0.103	0.076	0.291	0.106
Test for AR(1) residuals[b)]	0.000	0.000	0.000	0.000
Test for AR(2) residuals[c)]	0.069	0.213	0.209	0.023

Notes: Table reports system GMM estimates with dependent variable ln(unemployment rate), values in brackets are heteroskedasticity robust standard errors, *** (**) (*) signify significance at the 1% (5) (10%) level, respectively. Coefficients for time dummies are not reported. Net migration rates, compensation per employee and lagged unemployment rates are instrumented by their second lags and at most two additional lags in both the levels and difference equation using collapsed instruments throughout, all other variables are considered exogenous and treated accordingly (i.e. used as iv-type instruments). a) Probability value of Hanson test of over-identification restrictions b) Probability value of Arellano-Bond test for AR(1) residuals in first differences c) Probability value of Arellano-Bond test for AR(2) residuals in first differences.

Table 2: Results for GDP per capita at PPS

	(1) Including all migrants	(2) separate internal and external migrants	(3) only immigration regions	(4) only emigration regions
$\ln(\text{GDP per capita})_{t-1}$	0.949***	0.930***	0.965***	0.987***
	(0.012)	(0.022)	(0.018)	(0.021)
Net immigration rate	0.023***		0.015***	0.029***
	(0.005)		(0.005)	(0.009)
Net immigration rate from same country		0.044		
		(0.034)		
Net immigration rate from abroad		0.103***		
		(0.039)		
Investment share in GDP	0.161**	0.225**	0.109***	0.837***
	(0.056)	(0.111)	(0.031)	(0.225)
Natural population growth	-0.869	-2.877	-0.551	-0.730
	(0.526)	(1.984)	(0.622)	(1.925)
ln(share of highly educated)	0.012***	0.013	0.011***	0.018
	(0.003)	(0.008)	(0.002)	(0.019)
ln(share agriculture)	-0.010***	0.002	-0.008**	0.004
	(0.003)	(0.011)	(0.004)	(0.014)
Observations	1720	1080	1312	408
Number of groups	215	135	164	51
Instruments	17	18	17	17
Hansen J Statistic[a)]	0.353	0.223	0.368	0.375
Test for AR(1) residuals[b)]	0.000	0.003	0.000	0.000
Test for AR(2) residuals[c)]	0.377	0.125	0.074	0.420

Notes: Table reports system GMM estimates with dependent variable ln(GDP per capita at PPS), values in brackets are heteroskedasticity robust standard errors, *** (**) (*) signify significance at the 1% (5) (10%) level, respectively. Coefficients for time dummies are not reported. Net migration rates, investment share and lagged GDP per capita (at PPS) are instrumented by their second lags and at most two additional lags in both the levels and difference equation using collapsed instruments throughout, all other variables were considered exogenous and treated accordingly (i.e. used as iv-type instruments). a) Probability value of Hanson test of over-identification restrictions b) Probability value of Arellano-Bond test for AR(1) residuals in first differences c) Probability value of Arellano-Bond test for AR(2) residuals in first differences.

Table 3: Results for productivity

	(1) Including all migrants	(2) separate internal and external migrants	(3) only immigration regions	(4) only emigration regions
ln(real labor productivity)$_{t-1}$	0.882***	0.785***	0.852***	0.913***
	(0.047)	(0.102)	(0.067)	(0.032)
Net immigration rate	0.020**		0.029**	0.023**
	(0.010)		(0.014)	(0.011)
Net immigration rate from same country		-0.053		
		0.033		
Net immigration rate from abroad		0.014*		
		0.008		
Investment share in GDP	0.069**	0.096**	0.078**	0.243**
	(0.035)	(0.045)	(0.038)	(0.125)
ln(employment rate)	0.165	-0.224	0.024	0.259
	(0.227)	(0.191)	(0.411)	(0.167)
ln(share of highly educated)	0.033*	0.018**	0.085*	-0.025
	(0.017)	(0.008)	(0.046)	(0.026)
ln(share agriculture)	-0.032**	0.014	-0.080*	-0.003
	(0.016)	(0.019)	(0.048)	(0.018)
Observations	1720	1080	1312	408
Number of groups	215	135	164	51
Instruments	18	19	18	18
Hansen J Statistic[a)]	0.157	0.116	0.123	0.155
Test for AR(1) residuals[b)]	0.049	0.000	0.153	0.002
Test for AR(2) residuals[c)]	0.469	0.287	0.718	0.172

Notes: Table reports system GMM estimates with dependent variable ln(real productivity per worker), values in brackets are heteroskedasticity robust standard errors, *** (**) (*) signify significance at the 1% (5) (10%) level, respectively. Coefficients for time dummies are not reported. Net migration rates, investment share and lagged productivity as well as the employment rate are instrumented by their second lags and at most two additional lags in both the levels and difference equation using collapsed instruments throughout, all other variables were considered exogenous and treated accordingly (i.e. used as iv-type instruments). a) Probability value of Hanson test of over-identification restrictions b) Probability value of Arellano-Bond test for AR(1) residuals in first differences c) Probability value of Arellano-Bond test for AR(2) residuals in first differences.

Annex

Table A1: Variable names and sources

Code	Name	Source
ln(unemployment rate)	log of total unemployment rate	EUROSTAT
Net immigration rate	net migration rate in % of total population	EUROSTAT
Net immigration rate from same country	net internal migration rate in per cent of total population	EUROSTAT
Net immigration rate from abroad	net external migration rate in per cent of total population	EUROSTAT
ln(share of young population)	log of the share of under 25 year olds in population	EUROSTAT
ln(share of highly educated)	log of share highly educated (ISCED 5or higher) in total workforce	EUROSTAT
Natural population growth	log of natural population growth in age 15-65	EUROSTAT
ln(share agriculture)	log of share of aggricultural employed in total employment	EUROSTAT
ln(turbulence index)	Turbulence index (share of sectoral employment share changes in one year)	EUROSTAT
ln(herfindahl index)	Herfindahl Index (Sum of squares of sector shares)	EUROSTAT
ln(compensation per employee)	log compensation per employee	EUROSTAT
ln(GDP per capita)	Log of GDP per capita at PPS	EUROSTAT
ln(long term unemployment rate)	log growth of long-term unemployment rate	EUROSTAT
ln(real labor productivity)	log of real GDP per employed	CAMBRIDGE ECONOMETRICS
Investment share in GDP	gross fixed capital formation as share of GDP	CAMBRIDGE ECONOMETRICS