Determining the Impact of Cultural Diversity on Regional Economies in Europe

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Determining the Impact of Cultural Diversity on Regional Economies in Europe

Dirk Dohse, Robert Gold (IfW)

Contribution to the Project

Analyse the impact of cultural/ethnic diversity on innovation, regional economic performance, and growth. Lay the ground for the subsequent policy analysis.

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MS101 "Research report on task 503.3"

Determining the Impact of Cultural Diversity on Regional Economies in Europe

By Dirk Dohse*and Robert Gold+

ABSTRACT

In recent decades, the ethnic composition of the European population has changed substantially, leading to a rapid increase of cultural diversity in the EU as a whole, at the level of individual member states, and at the regional level. This paper focusses on the regional level and investigates the relationship between cultural diversity and regional economic performance for the EU 27. Giving particular attention to regional innovation, GDP per capita, and its development over time, the paper finds that culturally more diverse regions are on average more innovative, which translates into higher growth and better economic performance. An important finding of this study is, however, that the positive effect of cultural diversity on regional economic performance is not present in all sub-samples of the European regions alike.

JEL: M13, O18, R11
Keywords: Regional Development, Cultural Diversity, Measurement Issues

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1. Introduction

The current age is often characterized as the "age of migration", suggesting that more and more people are structurally 'on the move' (Baycan and Nijkamp 2011). Clearly, mobility is not a new phenomenon: Since early history there have been waves of migration, mainly as a response to exogenous forces like wars, famines, epidemics or natural disasters. Although part of the current mobility is undoubtedly fuelled by (more or the less) exogenous shocks like the global financial crisis, the Euro crisis or the conflict in Syria, the secular increase in mobility " … is increasingly an endogenous response to normal market conditions, a phenomenon that is strongly co-determined by our open and globalizing economy, with free movement of labour (as in the EU)." (Baycan and Nijkamp 2011: 1). As migrants usually bring along customs and traditions of their sending regions, migration affects the cultural diversity of the receiving regions, which might in turn affect the receiving regions' economic performance. This paper investigates the interrelation between (migration induced) ethnic and cultural diversity and regional development, innovation, and growth for the EU 27.

European integration may be viewed as an ongoing, large-scale experiment to study the impact of increasing cultural diversity, since there is hardly another region in the world accommodating people with so different cultures, attracting immigrants from all over the world and being dedicated to the continuous reduction of internal mobility restrictions as the European Union. Beginning with the South-North-labor migration waves of the 1960's and 1970's and continued with East-West migration flows after the fall of the iron curtain and a new wave of South-North migration triggered off by the Euro-Crisis, the ethnic and cultural composition of many European regions has changed considerably. The effects of Intra-European migration are augmented by immigration from countries outside the EU. Between 2009 and 2011, about 5 million people immigrated to one of the EU Member States from a country outside the EU. (Eurostat 2013). The latest figures available reveal that the United Kingdom faced the largest number of immigrants (566 044) in 2011, followed by Germany (489 422), Spain (457 649) and Italy (385 793). Relative to the size of the resident population, Luxembourg recorded the highest number of immigrants in 2011 (39 immigrants per 1000 persons), followed by Cyprus (27) and Malta (13) (Eurostat 2013: 36).

The EU-27 foreign population (people residing in an EU-27 Member State with citizenship of a non EU-27 Member State) on 1 January 2012 was 20.7 million, representing 4.1 percent of the EU-27 population. In addition, there were 13.6 million persons living in an EU-27 Member State with citizenship of another EU-27 Member State on 1 January 2012. In this

paper, we will employ the European Labour Force Survey (ELFS) to assess the regional distribution of foreigners within the EU27 member states. Figure 1 plots the shares of foreigners by country of origin as it is observed in the ELFS.[1]

[Figure 1 here]

In absolute terms, the largest numbers of foreigners living in the EU on 1 January 2012 were found in Germany (7.4 million), Spain (5.6 million), Italy (4.8 million), the United Kingdom (4.8 million), and France (3.9 million). In relative terms, the EU-27 Member State with the highest share of non-nationals was Luxembourg (43.8 percent of the total population). A high proportion of non-nationals (10 percent or more) was also observed in Cyprus, Latvia, Estonia, Spain, Austria, Belgium and Ireland. In most EU Member States the majority of non-nationals are citizens of non-EU countries. The opposite is true only for Luxembourg, Ireland, Belgium, Slovakia, Cyprus, Hungary, and the Netherlands. Figure 2 depicts the development of both the population share of foreign citizens and the cultural diversity according to this paper's preferred measure over time for an average region of the ELFS sample. As can be seen in Figure 2, the share of foreign citizens living in an average European region has steadily increased over time. The average region's cultural diversity has simultaneously increased, whereby the increase in diversity has on average been even stronger than just the increase in the share of foreigners.

[Figure 2 here]

While the degree of cultural diversity differs substantially across European regions (see Dohse and Gold 2013), cultural diversity is clearly increasing in Europe as a whole as well as at the regional level. This raises the question how the secular trend towards increasing cultural diversity affects important economic variables like innovation, growth, and eventually welfare. The aim of the current paper is to shed light on these economic impacts of cultural diversity, empirically investigating a (unbalanced) panel of all the EU 27 regions. In doing so, this paper relates cultural diversity to an array of macroeconomic outcome variables, thus drawing a comprehensive picture of the interrelation between cultural diversity and economic performance. Moreover, the paper investigates diversity effects for an average European region, using panel data on the universe of EU 27 regions. Additionally, the paper conducts

[1] Please note that the ELFS sample population expands as European Integration proceeds. We observe 22 countries in 2002 and 2003, where no detailed information of foreigners' region of origin is available. The number of EU27 member countries observed subsequently increases to 25 (in 2004), 26 (in 2005); and from 2009 on we eventually observe all EU27 member states.

subsample analysis to investigate the potential heterogeneity of these effects. Eventually, the paper discusses potential mechanisms behind the economic effects of cultural diversity, particularly focusing on diversity effects on innovation.

The results of this paper are relevant for the design of adequate innovation and growth policies in Europe and they also have implications for policies tackling regional cohesion and social exclusion. Thereby the paper addresses some central questions of the WWWforEurope project, namely the questions (i) how the EU can participate more strongly in world growth and guarantee a maximum well-being of its population, (ii) how increasing mobility and cultural diversity affect innovation, growth and the labor market, (iii) how openness and the socio-economic transformation of society affect economic well-being, regional cohesion and social coherence in Europe. The remainder of this paper is organized as follows: Section 2 briefly discusses the related literature this paper builds up upon. Section 3 introduces the data and describes the empirical strategy. Section 4 presents and discusses the empirical results. Section 5 concludes.

2. Related Literature

Marshall (1920) framed the notion of "knowledge in the air" being a locational factor conducive to regional development. Amongst many others, Becattini (1989), Saxenian (1994) and Audretsch and Feldman (1996) point out that knowledge is a regionally "sticky" (von Hippel, 1994) factor that generates spillovers and thus fosters innovation and growth. Jacobs (1961) explicitly relates innovation to the diversity of knowledge present in a given region. Along that line of arguments, Berliant and Fujita (2008) make heterogeneity an explicit argument in their knowledge production function. Conceptually, the paper at hand relates to this seminal literature assuming that cultural diversity is a regional input factor that positively affects a region's innovativeness and its growth potential as a consequence.

From a theoretical point of view, Berliant and Fujita (2012) explicitly consider the positive effects of cultural diversity on the production of new knowledge. Lazear (1999) models positive diversity effects on the productivity of teams on the firm level. However, he also takes increasing costs of diversity into account. Indeed, Ottaviano and Peri (2005, 2006) find empirical evidence for positive diversity effects on productivity using US city level data. Nathan (2011) confirms these findings for the UK. More generally, Alesina et al. (2013) establish a positive link between diversity and productivity which translates into positive diversity effects on economic development using data on 195 countries. Focusing on

European countries, Brenzel and Brunow (2011) find positive growth effects of ethnic diversity. Their paper is closely related to ours. With respect to the underlying mechanisms, Parrotta et al (2011) establish a link between cultural diversity and innovation on the firm level in Denmark. Our paper is, however, more closely related to Niebuhr (2010), who employs German data to analyze diversity effects on the regional level. She finds that cultural diversity positively affects regional innovation activities.

A more detailed overview over the literature on diversity effects is provided in Dohse and Gold (2013), including research focusing on negative impacts of (cultural) diversity. The paper at hand contributes to this literature in two important ways. First, it investigates the relation between cultural diversity and regional development for the universe of European regions, thus providing a broad analysis that is easily generalizable. Second, it establishes the link between diversity, innovation and development for the average region of the EU 27. Subsequently, we will discuss related papers time and again in more detail and relate their findings to our own empirical analysis.

3. Data Description and Empirical Approach

3.1 Data

To measure cultural diversity on the regional level, we use data from the European Labour Force Survey (ELFS) provided by Eurostat. The ELFS is a household survey conducted by the statistical offices of the EU member states and several other countries on a quarterly basis.[2] The first survey was conducted in 1983, but only in comparatively few countries. The ELFS sample expanded as EU integration proceeded. We use information from the ELFS beginning with the 2002 wave since it is our aim to assess diversity effects on broad scope for the "average region" of the EU 27. Along information on e.g. employment status, qualification, and some demographic variables, the ELFS also provides information on the nationality of the around 2-5 millions of individuals observed per year. We aggregate information from the ELFS at the regional level[3] and combine it with additional information provided by the Eurostat's regional statistics database.

For each region of the EU 27, the ELFS allows us to calculate the share of foreigners (based on individuals' citizenship) living in this region. We refer to the residual category as share of

[2] See Brenzel and Brunow (2011) for a detailed description of the data.
[3] We chose the lowest level of regional aggregation possible with the data at hand, i.e. NUTS-2 level or above. A detailed description of the data's regional structure can be found in the data appendix.

natives. Information on the regional share of foreigners is observed for the period 2002-2011 (although not for all EU 27 countries in the earlier years) and can be regarded to be a rough proxy for regional cultural diversity (c.f. Dohse and Gold 2013). From 2005 on, the ELFS additionally contains information on the region of origin of the foreigners living in the EU 27 regions.[4] We aggregate this information into 7 groups of origin, equally observed in all regions (EU 27, Other Europe, Northern Africa and Middle East, Other Africa, Asia, Australia and Northern America, Latin America) and use it to calculate regional diversity indices. For robustness checks, we equally split observations of aggregate regions of origin and recalculate the indices based on 12 regions of origin (EU 15, New Member States 12, Other Europe, Northern Africa, Other Africa, Near and Middle East, South-East Asia, Other Asia, Australia, Northern America, Central America, Southern America). Moreover, we use information on the country of birth of the observations in the ELFS and the share of foreign migrants (foreign citizens born abroad) for robustness checks.

Our preferred diversity index is the Theil index:

$$(1) \qquad theil_i = \sum_{n=1}^{N}(s_{ni})\ln\left(\frac{1}{s_{ni}}\right)$$

with s_{ni} indicating the share of any population group *n* (defined by its region of origin) in region *i*. Accordingly, a region's diversity results from the distribution of nationalities within the region's population, i.e. the relative size of the several ethnic-cultural subgroups, including the group of natives.

For robustness tests, we will employ the Herfindahl index which is also frequently used in the literature:

$$(2) \qquad herf_i = 1 - \sum_{n=1}^{N}(s_{ni})^2$$

The Herfindahl index follows a similar notion to measure diversity, i.e. by accounting for the distribution of nationalities in the overall regional population; but by squaring the shares, $herf_i$ gives relatively strong weight to large population groups. By taking the logs, $theil_i$ gives a stronger weight to the tails of the distribution, i.e. to population groups that are small in size. Thus, $theil_i$ accounts for non-linearities in the groups' contribution to a region's cultural diversity. We assume that some (foreign) culture's contribution to a region's cultural diversity is negatively related to group size, i.e. that the marginal benefits of (foreign) in-

[4] Malta is only observed from 2009 on.

migration to regional diversity decrease. Since the functional form of $theil_i$ accounts for this conjecture, we prefer the Theil index over the Herfindahl index when it comes to measuring regional cultural diversity.[5]

Regional level control variables are taken from the Eurostat Regional Statistics Database. Specifically, we use information on regional demographics (population density, female population share, share of working age population 15-64 years of age, share of population in retirement age 65 years and older, net-migration rate), qualification levels (share of economically active population with medium education, share of highly-educated individuals in the economically active population), economic structure (employment shares by industry), and factor input (employment share, average working hours, per capita gross fixed capital formation). If applicable, we add further output-specific controls. Moreover, all our output variables are calculated from the same database. The resulting dataset is described in Table 1. Details about our data compilation and the variables used can be found in the data appendix.

[Table 1 here]

3.2 Empirical Strategy

To assess the interrelation between cultural diversity and regional economic performance, we employ simple pooled OLS as our baseline model of the form

$$y_{it} = \alpha + \beta_1 div_{it} + X_{it}\beta'_2 + \alpha_c + \alpha_t + \varepsilon_{it} \quad (3)$$

where we regress different indicators of regional economic performance y_{it} on the regional levels of cultural diversity div_{it} as measured by the diversity indicators discussed above. X_{it} is a set of regional level control variables. To control for cyclical effects affecting all regions alike, we add year fixed effects α_t. To account for time-invariant differences in the institutional frameworks defined on the national level, we furthermore include country fixed effects α_c. ε_{it} is a regionally clustered error term.

While our baseline model allows us to investigate the connection between cultural diversity and regional economic performance, any results obtained might very well represent correlations that merely result from different levels of regional economic development. To further investigate our hypothesis that cultural diversity indeed contributes to economic

[5] See Dohse and Gold (2013) for an in-depth discussion.

growth and regional performance, we make use of the panel characteristics of our data in a next step by employing a standard first differences model of the form

$$\Delta y_{it} = \alpha + \beta_1 \Delta div_{it} + \Delta X_{it} \beta'_2 + \alpha_c + \alpha_t + \varepsilon_{it} \quad (4)$$

where we regress changes in the regional performance indicators Δy_{it} on changes in the regional cultural diversity Δdiv_{it}, controlling for simultaneous changes in other regional level variables related to economic performance. Taking first differences, level differences between the regions observed cancel out and we can directly relate regional economic development to cultural diversity. Still, we control for cyclical shocks with year fixed effects α_t and exploit only within-country variance in the regions' differences by including country fixed effects α_c.

4. Results

In a first step, our analysis focusses on the impact of cultural diversity on the level and development of regional GDP per capita. GDP per capita is perhaps the most fundamental measure of economic strength and prosperity and its development over time is indicative of the overall economic development of regions. In the subsequent steps, we will expand our analysis to other growth-related outcomes to investigate the mechanisms behind any observed GDP-effect of cultural diversity. Particularly, we will investigate the interrelation between cultural diversity and the innovativeness of regions.

4.1 Diversity and Regional Economic Performance

We begin with employing our baseline OLS model described in Equation (3) to regress regional per capita GDP on our basic Theil Index (based on 7 different groups of foreign citizens) as described in Equation (1), year and state fixed effects, and various regional-level control variables. Results are presented in Table 2. Column (1) presents coefficients of a regression on the Theil-Index and year fixed effects only. In column (2), state fixed effects are added to control for state-specific influences. In column (3), we further add controls for the regional demographic structure. Column (4) contains controls for the regional qualification structure. In column (5), we include controls for the regional industry structure instead. Column (6) controls for factor input. In Column (7), we add all control variables. Since we lose quite some observations due to missing values, we alternatively include only those controls which are almost universally available in Column (8). This is our preferred specification for the subsequent analyses.

[Table 2 here]

Table 2 reveals a positive and highly significant correlation between regional economic performance (as measured in terms of GDP per capita) and cultural diversity. This correlation is robust towards the inclusion of year and state fixed effects and a rich set of regional level control variables. It clearly turns out that more diverse regions perform better on average. The coefficients suggest that a one standard deviation higher diversity translates into 35.84 to 60.05 Euro higher GDP per capita, which corresponds to 0.17 to 0.28 percent higher GDP per capita in one SD more diverse regions.

4.1.1 Robustness

To test the robustness of our results, we repeat the previous estimations with alternative samples, performance and diversity indicators. Table 3 presents the results according to specification (8) of Table 2 using all non-missing control variables. In Column (1), we exclude Luxemburg, Brussels and Inner London from our sample, which are outliers both in terms of diversity and GDP per capita. Column (2) uses deflated GDP per capita (in 2005 prices) and Column (3) GDP measured in Purchasing Power Parities as outcome to rule out that our results are solely driven by differential developments of price levels or purchasing power.[6] In column (4), we recalculate the Theil-Index based on 12 disaggregated groups of foreigners. In Column (5) and Column (6), we use the Herfindahl Index as described in Equation (2) as alternative diversity measure (based on 7 and on 12 groups of foreigners, respectively). Eventually, in order to expand our period of analysis, we employ the regional share of foreign citizens as alternative and arguably rough measure of cultural diversity in Column (7), which nevertheless has the advantage of being observed from 2002 on. For comparison, we add the share of foreigners according to country of birth (Column (8)) and the share of foreign migrants (Column (9)), i.e. the share of foreign citizens that were born in a foreign country in the overall regional population.

[Table 3 here]

Table 3 clearly confirms the validity of our previous results. The correlation between cultural diversity and regional performance is robust to the exclusion of outliers and adjustments to the outcome measure that account for heterogeneity in the national price levels; and is not driven by the particular specification of our diversity measure. We conclude that it is safe to rely on the model specification presented in Column (8) of Table 2 for our subsequent

[6] Both price indices and Purchasing Power Standard are defined on the national level. We thus do generally not include them in our regional level analysis.

investigation. Moreover, comparing Columns (7) to (9) also supports our choice of citizenship as basic measure for calculating the diversity indices. For foreigners by country of birth, the diversity effect is less pronounced, which can be explained by foreign born individuals assimilating with the host region's culture in the course of changing citizenship. On the other hand, the diversity effect is more pronounced when we only regard foreign migrants that were certainly socialized in a cultural context different from the host region's context. Accordingly, citizenship seems indeed to be a good indicator for cultural affiliation.

4.1.2 Effect Heterogeneity

We now turn to the generalizability of the results obtained so far. Adding country fixed effects, we deliberately choose to not consider time-invariant differences between countries, but to only exploit within-country regional variation for assessing the general diversity effect for an average region. Still, this effect might significantly vary between different European regions. To further assess this potential effect heterogeneity, we repeat the estimations outlined in Equation (3) on several regional subsamples.

Results are reported in Table 4. Each column reports regression results for another subsample. In Column (1) and Column (2), we restrict the sample to the early member states of the EU 9 and the EU 15, respectively. These early member states have the longest history of European integration, which might specifically affect diversity effects. Subsequent columns report results for the broader geographic regions of Central-Western and Northern Europe (Column (3)), Southern Europe (Column (4)), and Central-Eastern Europe (Column(5)). These country samples differ both in terms of their post-war history as well as the overall levels of economic development. Column (6) restricts the sample to member states with an external border, which might be particularly affected by in-migration of non-EU foreigners, and Column (7) to former colonial powers (without Italy and Germany), which have a long tradition of in-migration of people from the former colonies – a fact that is also reflected in the citizenship regulations of these countries. Column (8) presents results for "Blue Banana" regions only, while Column (9) restricts the analysis to densely populated areas.

[Table 4 here]

As Table 4 reveals, the positive correlation between regional economic performance and diversity is not present in all European regions alike. Restricting the sample to earlier member states of the Union increases the coefficient slightly, while comparing Columns 3-5 reveals significant differences in the extent to which regional performance is affected by cultural

diversity. The positive relationship between GDP per capita and cultural diversity is particularly present in the Central, Western and Northern regions, while the average Southern region does not benefit from cultural diversity. Neither do Central and Eastern European regions, although the explanation for the non-effects of cultural diversity might be very different for these regions. In almost all Central and Eastern European regions, we observe very low levels of cultural diversity, which makes it difficult to measure any effects here. Southern European regions, on the opposite, do overall have diversity measures above the average. We do not dwell deeper into this heterogeneity here, but it might very well relate to actual composition of the foreign population in the Southern European countries that might be different from the average.

When we restrict the sample to European border regions that are potentially more affected by migration, we still find a positive correlation between regional performance and cultural diversity, although of lower magnitude than for the full sample. Most interestingly, regions in states with a colonial history do not benefit from cultural diversity, although these states are traditionally home to many migrants. Again, this might relate to the selectivity of certain migrant groups, but also to the faster integration of migrants from former colonies who still effectively contribute to the regional diversity, but are observed as natives in the ELFS. Moreover, blue banana regions – which are held to be particularly dynamic regions with respect to economic development – apparently benefit less from cultural diversity that the average European region, while densely populated in general show a very pronounced diversity effect.

4.2 Diversity and Economic Development over Time

Irrespective of the regional heterogeneity involved, we have found a remarkably robust correlation between regional economic performance and cultural diversity so far. However, this correlation might purely result from level effects, with (historically) more diverse region being better developed, and vice versa. To further investigate this interrelation, we now turn to the first differences model described in Equation (4), where we relate changes in per capita GDP on changes in regional diversity. Thus, time-invariant level differences cancel out, and we can directly assess whether increases in cultural diversity lead to differences in the regional economic development. Results are presented in Table 4, where different columns refer to changes in the sets of control variables as already discussed with respect to Table 2.

[Table 5 here]

In the first differences model we find, again, a significant correlation between regional economic performance and cultural diversity that is robust to the inclusion of various regional level control variables. More specifically, Table 4 reveals a significant correlation between changes in cultural diversity and changes in regional GDP per capita, irrespective of the regional levels of per capita GDP. We capture demand-side explanations by controlling for changes in the population structure, the qualification structure, and the infrastructure. Moreover, changes in population density and net migration rate control for the regions' overall attractiveness to migrants, irrespective of their cultural background. Changes in the employment share, working hours and capital input grasp developments on the regional labor markets. Thus, we are confident that the positive correlations reported in Table 5 can indeed be attributed to increases in cultural diversity.

The coefficients suggest that a one standard deviation increase in cultural diversity relates to a 0.33 Euro increase in GDP per capita, or a 0.08 percent stronger GDP per capita growth. This is an arguably small effect for the average region. Still, this is a reasonable magnitude, given that there are potentially more important factors than diversity that affected the economic development of the average European region over the period 2006-2010. However, our subsample (Table 4) results suggest that diversity effects are heterogeneous, and that certain regions might benefit much more from increases in cultural diversity.

4.3 Mechanisms

4.3.1 Productivity and Wealth

Although small in size, increasing cultural diversity has a significantly positive effect on the economic development of the average European region, and an even more pronounced effect on regional performance levels. By now, we have assessed diversity effects on per capita GDP, which is a catch-all indicator for welfare, wealth and economic performance. In the subsequent analysis we dwell a bit deeper to disentangle some mechanisms potentially driving this effect. First, we differentiate between diversity effects on wealth, productivity and income. Specifically, we are interested in whether cultural diversity might be related to regional productivity, or whether the GDP effect is only driven by income effects that might result from selective migration (and the related changes in cultural diversity) of individuals with high income potential. To investigate these conjectures, we repeat the estimations outlined in Equation (1) and Equation (2) with three GDP-related outcomes: Disposable household income (hinc), Gross Value Added (gva), and wages (wage). Results are reported

in Table 5, where the upper Panel A presents results of the level estimations according to Equation (1) and the lower panel B presents results of the first difference model outlined in Equation (2). Columns with odd numbers contain regression results using all available controls (corresponding to Column (7) of Tables 2 and 5), even columns report regression coefficients for estimations containing only control variables without missing values (corresponding to Column (8) of Tables 2 and 5).

[Table 6 here]

Indeed, cultural diversity is correlated with both, regional income and productivity. Households in diverse regions are richer, and their income grows stronger if diversity increases. The same holds true for regional gross value added per capita as measure of regional productivity. Regional wages capture both, regional productivity and regional wealth. Accordingly, Table 6 reveals that wages are on average higher in more diverse regions, and that wages increase on average stronger if cultural diversity increases. The wage effect also hints at a conjecture between regional cultural diversity and labor market performance. In a next step, we will investigate whether the positive connection between cultural diversity and regional productivity relates to diverse regions being more innovative.

4.3.2 Innovation

In modern, highly integrated economies the ability to create new knowledge and to acquire and use new knowledge created elsewhere are key determinants of growth and economic well-being. Modern growth theories referred to as theories of Schumpeterian growth have typically three things in common (Aghion et al 2013:2): (i) they are about growth generated by innovations; (ii) innovations result from risky investments in R&D, motivated by the prospect of monopoly rents and (iii) they involve creative destruction, i.e. new, innovative technologies replace old technologies, thereby increasing productivity, growth and, finally, wealth.

While the innovation-growth nexus is well-established in the theoretical as well as in the empirical literature and appears to be common sense also among policy makers in Europe, the U.S., Japan and many of the fast-growing emerging economies, much less is known about the impact of cultural diversity on the ability of regional economies to create (and adopt) new knowledge. Arguments in favor of a positive impact of cultural diversity on innovation are usually traced back to the pioneering work by Jane Jacobs (Jacobs 1961). According to Jacobs, diversity in its various dimensions (including diversity of commercial and cultural

activities, a diverse urban population, diverse skills, tastes and demands) is a key engine of urban development. In the same vein, Sakia Sassen has argued that a culturally diverse population is an important asset and a key characteristic of global cities (Sassen 1994). Richard Florida has popularized the argument that the urban "melting pot" enhances the potential for mutual learning and knowledge spillovers across economic agents, thereby stimulating innovative activities and growth (Florida 2002). Moreover, a diverse urban environment attracts knowledge workers and augments the creative capital of cities, thereby improving the prospects for knowledge-based growth (ibid.).

Audretsch, Dohse and Niebuhr (2010) have suggested a different mechanism, combining Jacob's diversity argument with the knowledge spillover theory of entrepreneurship. The knowledge spillover theory of entrepreneurship (Acs et al. 1994, 2009) suggests that R&D investment by incumbent firms creates localized knowledge spillovers, as knowledge creation processes are inherently uncertain and much new, unintended knowledge is created as a by-product. As only part of the newly created knowledge is perceived, correctly assessed and commercially exploited by the incumbent investors, regional R&D investment creates a large reservoir of entrepreneurial opportunities that can be exploited by newcomers to entrepreneurship. While the knowledge spillover theory of entrepreneurship provides a convincing explanation for the supply of knowledge spillovers at the regional level, it fails to model the regional demand for knowledge spillovers.

Here Audretsch et al. (2010) set in, suggesting that cultural diversity at the regional level provides a mechanism that increases the regional demand for knowledge spillover, thereby increasing the likelihood of a match between a given "piece" of newly created knowledge in the region and an individual that is able to perceive, assess and commercially exploit that new piece of knowledge. Their principal argument is as follows:

> "*Thus, while knowledge may be important to generate new ideas, it is the assessment of those new ideas by diverse economic agents characterized by differences in experiences, backgrounds, and capabilities that leads to divergences in the valuation of such ideas which ultimately induce agents to resort to entrepreneurship to appropriate the value of their knowledge endowments. This suggests that for knowledge spillovers to occur, more than investments in new knowledge is required. Rather, economic agents with the capabilities to access, absorb and commercialize that knowledge through the spillover conduit of entrepreneurship are also essential for generating knowledge spillovers.*

Diversity will enhance such entrepreneurial activity because diverse economic agents will value new ideas differently, leading them to respond to different ideas in a different way." (Audretsch et al. 2010: 58)

Another relevant direction of research is recent work by Lazear on skill balance (2004, 2005) and inter-cultural teams (1999). Lazear's work suggests that homogenous economic agents have little to learn from each other. Hence, starting from a homogenous population and increasing diversity (in terms of skills, education, cultural background, etc.) is clearly conducive to innovation and economic performance. There are, however, also opposite forces at work: too much heterogeneity/diversity may hinder effective communication and cooperation and lead to misunderstandings and conflict. Hence, it is likely that there exists an optimal level of diversity, suggesting an inverted U-shape relationship between cultural diversity and innovation. Just recently, Ott and Dohse (2014) have adapted Lazear's notion of skill balance and have integrated economic agents (entrepreneurs) with heterogeneous skills into a Schumpeterian growth model. They show that growth and convergence of countries close to the world technology frontier depend critically on the right balance of economic agents with different skills.

Hence, from a theoretical point of view there exist good arguments for assuming that cultural diversity is conducive to innovation and growth. However, empirical evidence on the impact of cultural diversity on innovation has only emerged recently and is still scarce and inconclusive as yet: Early work by Hunt and Gauthier-Loiselle (2008) investigates the impact of highly skilled immigrants on patenting at the state level in the US and finds a strong positive effect. In a similar study for Canada, Partridge and Furtan (2008) find a positive impact of immigrants on patenting in Canadian provinces. The positive impact is, however, restricted to highly skilled immigrants from developed countries such as Western Europe and the US. Lincoln and Kerr (2010) quantify the impact of changes in H-1B admission levels on the pace and character of US invention over the 1995-2008 period. The H-1B visa program governs most admissions of temporary immigrants into the US for employment in science and engineering (SE). Lincoln and Kerr (2010) find that fluctuations in H-1B admissions significantly influenced the rate of Indian and Chinese patenting in cities and firms dependent upon the program relative to their peers. Niebuhr (2010) has analysed the effect of cultural diversity of the labour force on patent applications for a cross-section of German regions, finding that differences in knowledge and capabilities of workers from diverse cultural backgrounds enhance performance of regional R&D sectors. Ozgen, Nijkamp and Poot (2011)

use a panel of 170 NUTS-2 regions and two periods (1991-1995 and 2001-2005). They find that patent applications are positively affected by the diversity of the immigrant population, whereas the sheer size of the immigrant population (as measured by the share of foreigners) has no clear-cut effects.

Our approach is closest in spirit to the work by Niebuhr (2010), extending it to the EU-27. We use patents per capita as measure of a region's innovative output, and assess whether this output is higher in more diverse regions by employing our baseline model described in Equation (1). Results are presented in Table 7. Panel A in the upper part employs our baseline model as before. Since we find strong indications for a nonlinear relationship between patent output and cultural diversity, we report the results of a nonlinear specification of our baseline model in lower panel B, where we report coefficients for a centered Theil index and its square. Additionally to our previously used control variables, we control for R&D specific input factors (share of research personal in the population, research expenditure per capita) in Column (6) and Column (9).

[Table 7 here]

Indeed, we find strong indication that cultural diversity affects regional economic performance by fostering innovation. Patent output is significantly higher in more diverse regions. Our results suggest that one standard deviation higher diversity corresponds to 0.008 to 0.014 more patents per hundred thousand capita. In other terms, patent output is by 0.12 to 0.21 percent higher in regions with one SD more diversity. This effect turns out to be stronger if we control for non-linearities in the relationship between patents and diversity. This significant nonlinearity is an interesting finding by itself. The coefficients reported in Panel B imply an inverted U-shape in the relationship between innovative output and cultural diversity, which would be in line with both: a decreasing marginal utility of diversity and an increasing cost of diversity related to transaction costs.

A further mechanism by which cultural diversity might affect regional economic performance is entrepreneurship (see Audretsch et al 2010). Unfortunately, however, the Eurostat regional statistics does not provide an adequate Europe-wide measure of entrepreneurial activity at the regional level. Self-employment is a rather poor proxy, as it is much too broad, heterogeneous, biased towards agriculture and does not reflect the dynamics of new venture creation. We nevertheless ran regressions with self-employment as dependent variable which – not surprisingly – led to insignificant results. Hence, investigating the interrelation between

cultural diversity, innovation and entrepreneurship more thoroughly must be left to future research.

5. Summary and Conclusions

The current paper has analyzed the impact of cultural diversity on regional economic performance and development in the EU-27. We find a highly significant, positive correlation between a region's cultural diversity and its GDP per capita. This correlation is robust towards the inclusion of year and state fixed effects and a rich set of regional level control variables. It is also robust to different specifications of the diversity measure, the exclusion of outliers and adjustments of the outcome measure that account for heterogeneity in the national price levels. It clearly turns out that more diverse regions are on average better developed. A major finding of this study is, however, that the positive correlation between cultural diversity and regional economic performance is not present in all European regions alike. The strongest impact of cultural diversity on regional GDP per capita is found in the long-term member states of the EU (EU-9 and EU-15), in Central and Western Europe and, in particular, in densely-populated regions. The effect is much weaker in border regions and absent (or even slightly negative) in Southern and Eastern Europe. Our findings suggest that:

(i) There might be a positive link between cultural diversity and the level of integration. Long-term EU members benefit more from immigration/diversity, as they have (in the course of integration) developed the necessary openness, institutions and absorptive capacity to take advantage of immigration.

(ii) There might be a positive link between cultural diversity and the density of economic activity. Densely populated regions offer more economic opportunities (entrepreneurship, broader spectrum of wage employment) for immigrants and, at the same time, dispose of a higher absorptive capacity, enabling them to make productive use of the inflow of people with diverse skills.

The positive relationship between cultural diversity and GDP/capita also holds when we move to first differences instead of levels. In other words: Changes in cultural diversity lead to changes in regional GDP/capita in the same direction, irrespective of the level of regional development already achieved. This effect is robust to different specifications (different sets of control variables, different diversity indices, etc.), but rather small. Again, however, this effect is stronger for long-term EU member states and densely populated regions, suggesting that certain regions might benefit much more from increases in cultural diversity than others.

Turning to the mechanisms that drive GDP effects, we find a positive impact of cultural diversity on regional productivity (gross value-added) as well as on wages. Following Schumpeterian growth theory, we give particular attention to the innovation channel as core driver of growth. We regress patents per capita on cultural diversity, R&D input and various other control variables, and find indication that cultural diversity affects regional economic performance by fostering innovation. Patent output is significantly higher in more diverse regions – an effect that turns out to be even stronger if we control for non-linearities in the relationship between patents and diversity.

In a nutshell, our results hint at a strong positive relationship between cultural diversity at the regional level and regional economic development, with innovation being a main transmission channel turning higher cultural diversity into higher GDP/capita. Although our results are robust over a large range of model specifications, controls and diversity measures, some qualifications are necessary:

— We measure the impact of cultural diversity on output variables (GDP/capita) as well as the impact of periodical changes of cultural diversity on changes of GDP/capita. The available time series are, however, not long enough to establish a clear-cut positive relationship between cultural diversity and long-term economic growth.
— The results are strongest for a core group of long-term EU member states and for densely populated regions. They are less strong / absent in sparsely populated, peripheral regions and in the new member states.
— We cannot entirely rule out that our results are confounded with unobserved regional heterogeneity, i.e. time variant factors affecting both, regional diversity and performance. But given the richness of our regional control variables and the robustness of our results, we are confident that the relationship between cultural diversity and regional performance is indeed significant.

Still, this paper shows that the effects of cultural diversity on regional innovation and economic development are small in size. It must be kept in mind, however, that these results apply to the average region of the EU 27. Most obviously, certain regions might benefit much more from cultural diversity, while other regions are hardly affected – for different reasons. This relates to potential interactions of cultural diversity with other regional-level variables decisive for innovation and growth, that must be investigated to better understand the channels through which cultural diversity contributes to regional economic performance. This

would, however, require an in-depth analysis of certain subsamples of the EU 27 regions and goes well beyond the scope of this paper.

We draw two policy inferences from our empirical results:

First, policies facilitating *migration* and *integration* of migrants may be regarded as *innovation* policies as well. Apparently, the huge heterogeneity of European regions with respect to both: their cultural diversity per se and their ability to make use of this diversity as resource in the innovation systems presents a challenge to future integration *and* innovation policies. Second, the cultural composition of migrant populations affects the returns to immigration. More diversity appears to have a positive impact on regional economic performance. Nevertheless, there are also indications that this relationship might be non-linear, and that there might be an optimal level of diversity. More research on these interrelations will help to quantify the returns under different conditions. But understanding migration policy as means of innovation policy is a first step to enabling regions to tap into cultural diversity as input factor to innovation and growth processes. A second step would be to designing policies that consider the composition, not only the size of the foreign population when dealing with migration effects.

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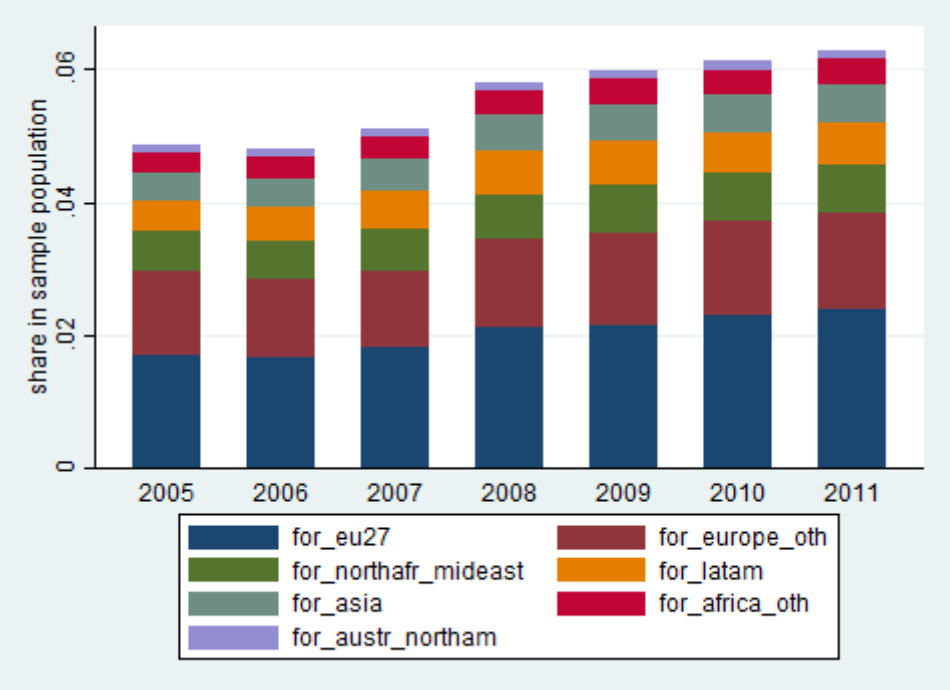
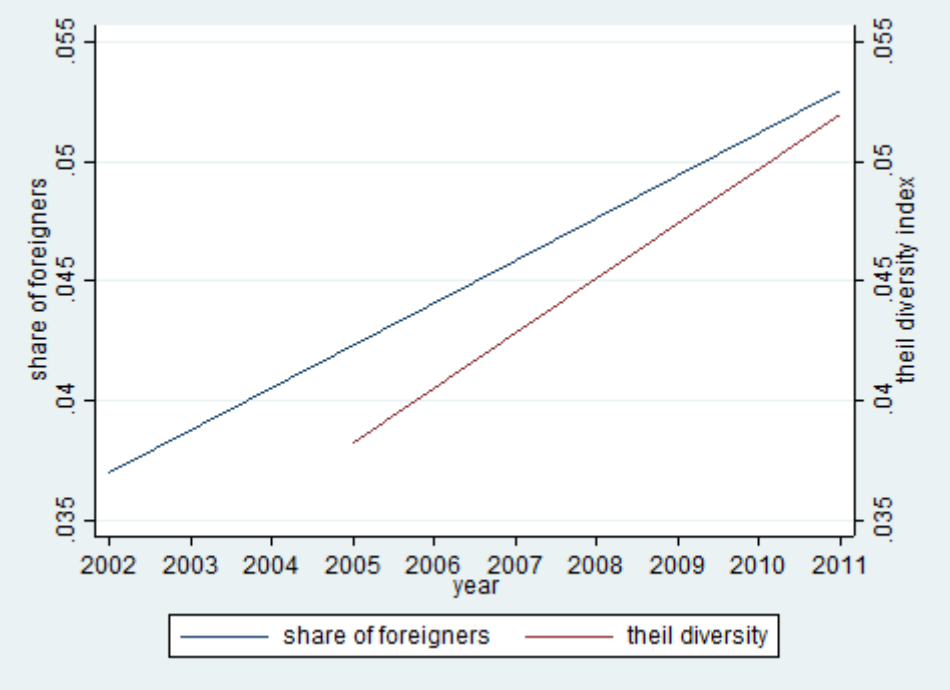
Tables and Figures

Figure 1: Share of Foreigners in EULFS Sample Population



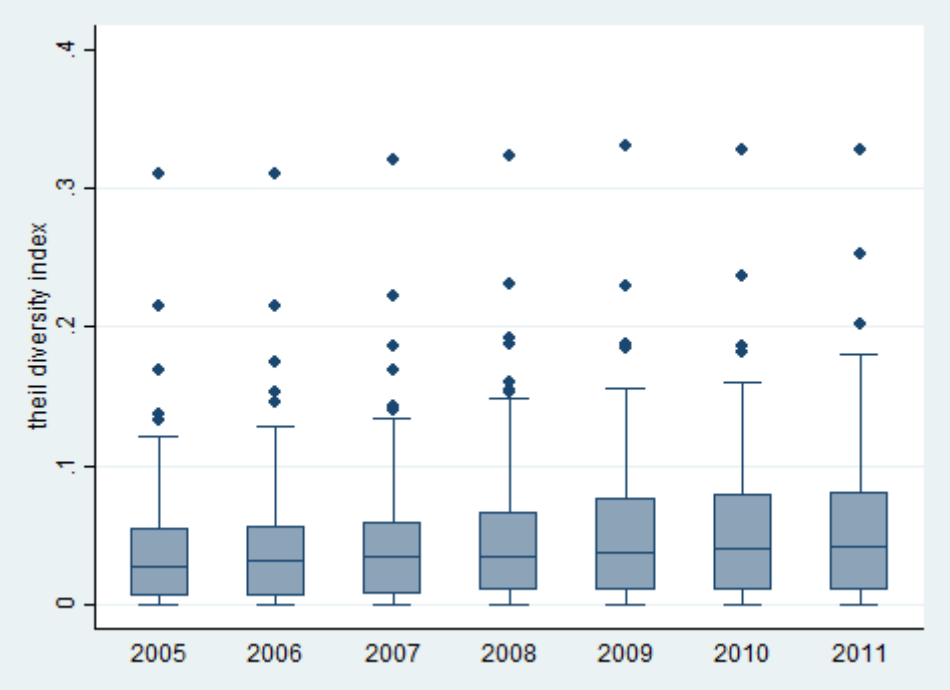
Notes: Figure depicts share of foreigners from EU 27 countries (for_eu27), foreigners from other European countries (for_europe_oth), foreigners from Northern Africa and the Midle East (for_northafr_mideast), foreigners from Latin America (for_latam), foreigners from Asia (for_asia), foreigners from other Africa (for_africa_oth), and foreigners from Australia and Northern America (for_austr_northam) in the EULFS sample population of the respective year. Shares add up to the share of foreign citizens observed in the sample population.

Figure 2: Average Regional Diversity Development



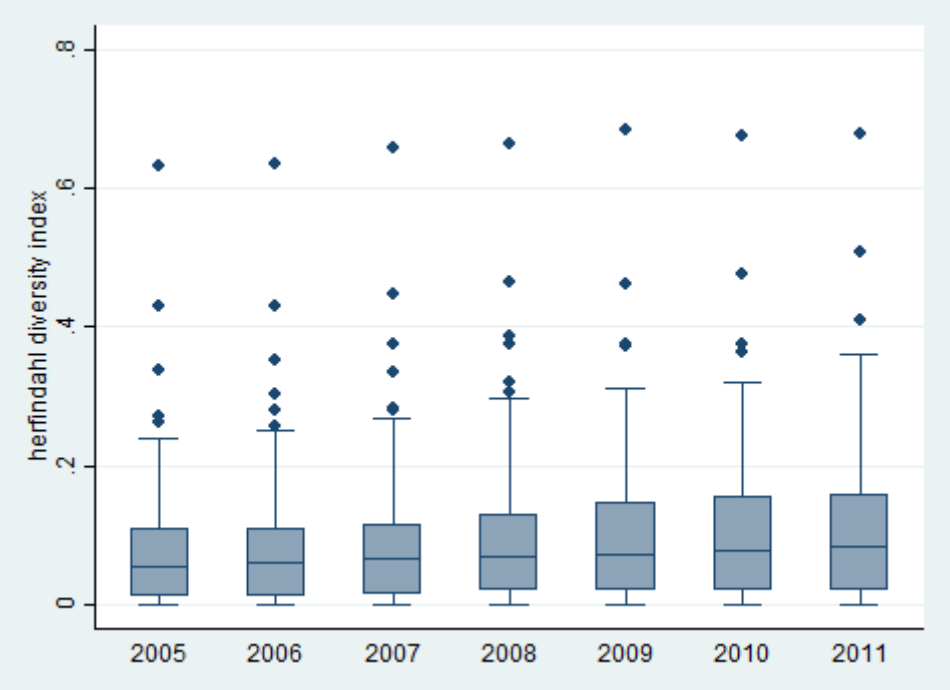
Notes: Figure depicts share of foreign citizens and cultural diversity as measured by the Theil index for an average EULFS region over time.

Figure 3: Box Plot Theil Index



Notes: Figure depicts distribution of (regionally defined) Theil Index values over time.

Figure 4: Box Plot Herfindahl Index



Notes: Figure depicts distribution of (regionally defined) Herfindahl Index values over time.

Table 1: Descriptive Statistics

Variable	Sample 2002-2010			Sample 2005-2010		
	min	mean	max	min	mean	max
gdp pc	0.0016	0.0205	0.0795	0.0022	0.0211	0.0795
(millions €)		(0.0111)			(0.0113)	
household income pc	0.0010	0.0126	0.0279	0.0013	0.0129	0.0279
(millions €)		(0.0059)			(0.0059)	
gross value added pc	0.0014	0.0184	0.0720	0.0019	0.0189	0.0720
(millions €)		(0.0099)			(0.0101)	
wage pc	0.0005	0.0099	0.0375	0.0008	0.0101	0.0375
(millions €)		(0.0059)			(0.0060)	
patents pc	0.0000	0.0073	0.0587	0.0000	0.0070	0.0587
(number/100 capita)		(0.0094)			(0.0093)	
population	26,008	2,501,406	18,079,686	26,530	2,524,843	18,079,686
(number)		(2,641,310)			(2,615,137)	
area	1.30	2219.79	22678.56	1.30	2,197.78	22678.56
(1000 ha)		(2560.24)			(2,494.86)	
share of foreigners	0.0000	0.0444	0.4380	0.0000	0.0462	0.4380
		(0.0510)			(0.0518)	
theil diversity		n.a.		0.0000	0.0442	0.3306
					(0.0458)	
herfindahl diversity		n.a.		0.0000	0.0875	0.6842
					(0.0918)	
population share 15-64	0.6175	0.6724	0.7704	0.6175	0.6729	0.7466
		(0.0257)			(0.0256)	
population share ue65	0.1040	0.1695	0.2682	0.1051	0.1716	0.2682
		(0.0302)			(0.0312)	
net migration rate	-0.0234	0.0034	0.0353	-0.0234	0.0032	0.0348
		(0.0058)			(0.0056)	
share med. qualification	0.0943	0.4838	0.8305	0.1176	0.4895	0.8218
		(0.1642)			(0.1590)	
share high qualification	0.0690	0.2379	0.5195	0.0748	0.2418	0.5195
		(0.0835)			(0.0846)	
employment share	0.2213	0.6200	0.8287	0.3132	0.6231	0.8287
		(0.0779)			(0.0766)	
R&D personel pc	0.0000	0.0038	0.0178	0.0002	0.0038	0.0178
		(0.0029)			(0.0029)	
R&D expenditures pc	0.0000	0.0003	0.0025	0.0000	0.0003	0.0025
		(0.0004)			(0.0004)	
No of Obs	150 p.a.	1,653 total	197 p.a.	196 p.a.	1,178 total	197 p.a.

Notes: Table reports Descriptive Statistics for the most important variables used. Standard Deviations are given in parentheses.

Table 2: Cultural Diversity and Economic Performance

gdp per capita	(1) year FE	(2) country FE	(3) demographics	(4) qualification	(5) industry struct.	(6) factor input	(7) all ctr.	(8) non-missing ctr.
theil diversity	0.174***	0.123***	0.094***	0.108***	0.090***	0.070***	0.037***	0.062***
	(0.014)	(0.018)	(0.015)	(0.013)	(0.017)	(0.015)	(0.008)	(0.011)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	N	Y	Y	Y	Y	Y	Y	Y
Controls	N	N	Y	Y	Y	Y	Y	Y
Observations	1,168	1,168	1,168	1,168	1,166	1,126	1,124	1,166
Adj. R-squared	0.496	0.834	0.863	0.876	0.863	0.921	0.951	0.929

Notes: Table reports regional level pooled OLS regression results with per capita GDP (in millions Euro) as outcome. Standard errors are clustered on the regional level. Significance: ***0.01 , **0.05, *0.10.

Table 3: Cultural Diversity and Economic Performance - Robustness

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
gdp per capita	no outliers	2005 prices	PPP	Theil 12 groups	Herf 7 groups	Herf 12 groups	share of foreigners (citizenship)	share of foreigners (country of birth)	share of foreign migrants
diversity	0.054***	0.059***	0.052***	0.062***	0.031***	0.031***	0.055***	0.036***	0.058***
	(0.011)	(0.010)	(0.010)	(0.011)	(0.005)	(0.005)	(0.009)	(0.008)	(0.010)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	1,148	1,166	1,166	1,166	1,166	1,166	1,641	1,641	1,641
Adj. R-squared	0.915	0.928	0.887	0.929	0.929	0.929	0.926	0.923	0.924

Notes: Table reports regional level pooled OLS regression results with per capita GDP (in millions Euro) as outcome, if no other outcome is specified in the column heading. If not specified otherwise in the column headings, Theil index is used as diversity measure. Standard errors (in parentheses) are clustered on the regional level. Significance: ***0.01 , **0.05, *0.10.

Table 4: Effect Heterogeneity - Subsamples

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
gdp per capita	eu9	eu15	center-west	south	cee	border	col_pow	blue	dens
theil diversity	0.067***	0.062***	0.071**	-0.001	-0.012*	0.021**	-0.004	0.017	0.106***
	(0.021)	(0.012)	(0.030)	(0.008)	(0.007)	(0.009)	(0.018)	(0.018)	(0.025)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y	Y	Y	Y
Observations	512	836	396	356	240	572	276	180	108
Adj. R-squared	0.884	0.874	0.893	0.904	0.936	0.948	0.918	0.926	0.969

Notes: Table reports regional level pooled OLS regression results with per capita GDP (in millions Euro) as outcome. Different subsamples are specified in the respective column headings. Standard errors (in parentheses) are clustered on the regional level. Significance: ***0.01 , **0.05, *0.10.

Table 5: Cultural Diversity and GDP Growth

Δ gdp per capity	(1) year FE	(2) country FE	(3) demographics	(4) qualification	(5) industry struct.	(6) factor input	(7) all ctr.	(8) non-missing ctr.
Δ theil diversity	0.009**	0.014***	0.009**	0.013***	0.014***	0.014**	0.008*	0.008*
	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)	(0.006)	(0.004)	(0.004)
Year FE	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	N	Y	Y	Y	Y	Y	Y	Y
Controls	N	N	Y	Y	Y	Y	Y	Y
Observations	971	971	971	971	970	936	935	970
Adj. R-squared	0.372	0.437	0.450	0.436	0.445	0.370	0.472	0.463

Notes: Table reports regional level pooled OLS regression results with changes in per capita GDP (in millions Euro) as outcome. Control variables are specified in the respective column headings. Standard errors (in parentheses) are clustered on the regional level. Significance: ***0.01 , **0.05, *0.10.

Table 6: Mechanisms behind GDP Effect

outcomes per capita:	(1) disposable hh inc.	(2) disposable hh inc.	(3) gross value added	(4) gross value added	(5) wage	(6) wage
Panel A:						
theil diversity	0.010**	0.016***	0.035***	0.058***	0.020***	0.030***
	(0.005)	(0.005)	(0.007)	(0.010)	(0.004)	(0.005)
Observations	1,107	1,148	1,124	1,166	1,134	1,176
Adj. R-squared	0.957	0.956	0.948	0.926	0.962	0.948
Panel B:						
Δ theil diversity	0.006***	0.006***	0.008**	0.007*	0.005**	0.004**
	(0.002)	(0.002)	(0.004)	(0.004)	(0.002)	(0.002)
Observations	920	954	935	970	945	980
Adj. R-squared	0.378	0.364	0.445	0.435	0.382	0.373
Year FE	Y	Y	Y	Y	Y	Y
Country FE	Y	Y	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y

Notes: Table reports regional level pooled OLS regression results with levels (Panel A) and changes (Panel B) of the variables specified in the respective column headings as outcome. Standard errors (in parentheses) are clustered on the regional level. Significance: ***0.01 , **0.05, *0.10.

Table 7: Cultural Diversity and Innovation

patents per capita	(1) year FE	(2) country FE	(3) demographics	(4) qualification	(5) industry struct.	(6) factor input	(7) specific input	(8) all ctr.	(9) non-missing ctr.	(10) (9) plus (7)
Panel A:										
theil diversity	0.071***	0.047**	0.061***	0.034*	0.039*	0.037**	0.010	0.040***	0.043***	0.024**
	(0.016)	(0.019)	(0.022)	(0.018)	(0.020)	(0.016)	(0.012)	(0.015)	(0.015)	(0.011)
Adj. R-squared	0.149	0.582	0.613	0.610	0.623	0.609	0.755	0.743	0.745	0.800
Panel B:										
theil diversity (demeaned)	0.121***	0.128***	0.117***	0.114***	0.119***	0.108***	0.057***	0.070***	0.074***	0.045***
	(0.022)	(0.029)	(0.027)	(0.026)	(0.027)	(0.027)	(0.019)	(0.019)	(0.019)	(0.016)
theil^2	-0.512**	-0.896***	-0.909***	-0.889***	-0.875***	-0.773***	-0.494***	-0.449***	-0.452***	-0.298**
	(0.197)	(0.214)	(0.182)	(0.195)	(0.191)	(0.200)	(0.126)	(0.145)	(0.144)	(0.136)
Adj. R-squared	0.220	0.622	0.641	0.649	0.661	0.635	0.766	0.748	0.751	0.802
Year FE	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Country FE	N	Y	Y	Y	Y	Y	Y	Y	Y	Y
Controls	N	N	Y	Y	Y	Y	Y	Y	Y	Y
Observations	1,020	1,020	1,020	1,020	1,018	983	1,020	981	1,018	1,018

Notes: Table reports regional level pooled OLS regression results with per 100 capita patents as outcome. Panel A reports coefficients of the Theil Index, Panel B of the demeaned Theil Index and its square. Column headings specify the control variables included. Standard errors (in parentheses) are clustered on the regional level. Significance: ***0.01 , **0.05, *0.10.

Data Appendix:

Data compilation

Data have been compiled from the European Labour Force Survey and the Eurostat Regional Statistics. To be able to merge the datasets and to ensure consistency in the territorial structure over the whole period of analysis 2002-2011, we aggregated information on some regions. The Finish regions FI13 and FI1A have been aggregated to region FI1D, regions FI1B and FI1C have been aggregated to region FI18. All Dutch regions have been aggregated on the Nuts 0 level. All Danish, Austrian and German regions and regions in the UK have been aggregated on the Nuts 1 level. The regions observed in the final dataset are described in Table A1.

[Table A1 here]

Adjustments

Regional level control variables come from the Regional Statistics of Eurostat. When adding sets of control variables, we have to deal with accumulated missing values. In order not to lose too many observations, we thus decided to impute missing values of regional control variables. If values are missing for certain regions in specific years, we impute the region's mean value of this variable calculated over the period the region is observed. The control variable for the regional capital stock has for every given year been calculated from the accumulated gross fixed capital formation over the previous five years. Accordingly, we impute mean gross fixed capital formation over the same five years period in the case of missing values. Note that we neither impute outcome nor explanatory variables. A comparison of the raw data and the dataset with imputations used in the paper can be found in Table A2.

[Table A2 here]

Variable Description

Control variables and outcome variables stem from the Eurostat Regional Statistics, while explanatory variables are calculated from the ELFS. Table A3 provides a detailed description of the variables used in the paper.

[Table A3 here]

Appendix Tables and Figures

Table A1: Regions Observed

Country ID	Country Name	No. of Regions	NUTS-Level	First observed
AT	Austria	3	1	2002
BE	Belgium	11	2	2002
BG	Bulgaria	6	2	2002
CY	Cyprus	1	2	2002
CZ	Czech Republik	8	2	2002
DE	Germany	16	1	2002
DK	Denmark	1	1	2002
EE	Estonia	1	2	2002
ES	Spain	19	2	2002
FI	Finland	4	2	2002
FR	France	22	2	2002
GR	Greece	13	2	2002
HU	Hungary	7	2	2002
IE	Ireland	2	2	2002
IT	Italy	21	2	2005
LT	Lithunia	1	2	2002
LU	Luxembourg	1	2	2002
LV	Latvia	1	2	2004
MT	Malta	1	2	2009
NL	Netherlands	1	0	2002
PL	Poland	16	2	2004
PT	Portugal	7	2	2002
RO	Romania	8	2	2004
SE	Sweden	8	2	2002
SI	Slovenia	2	2	2002
SK	Slovakia	4	2	2002
UK	United Kingdom	12	1	2002

Notes: Table reports number of regions observed in the ELFS by country, regions' NUTS level, and first year of a countries' occurrence in the ELFS data.

Table A2: Mean Comparison Before and After Imputation

Variable	Mean Before	Mean After	Difference
population	2503045	2506262	-3217
(Obs.)	1838	1850	
pop. female	1281626	1283325	-1699
(Obs.)	1838	1850	
pop. 15-64	1682365	1683175	-810
(Obs.)	1830	1850	
pop. >=65	421702	422541	-839
(Obs.)	1830	1850	
net migration	7215.19	7346.93	-131.73
(Obs.)	1815	1850	
employed persons 15-64	1074.08	1072.88	1.2
(Obs.)	1800	1850	
economically act. pop. low education	300.05	300.44	-0.77
(Obs.)	1800	1850	
economically act. pop. medium education	578.23	576.62	1.61
(Obs.)	1798	1850	
economically act. pop. high education	309.8	307.35	2.45
(Obs.)	1794	1850	
R&D expenditures	944.3338	1131.303	-186.97**
(Obs.)	1210	1850	
R&D personel	10773.54	11899.10	-1125.56
(Obs.)	1200	1850	

Variable	Mean Before	Mean After	Difference
employment nace b	3644	3414	230
(Obs.)	1372	1829	
employment nace c	169413	162890	6524
(Obs.)	1467	1847	
employment nace d+e	7390	7390	0
(Obs.)	1850	1850	
employment nace f	68167	66416	1751
(Obs.)	1477	1847	
employment nace g	166539	162063	4477
(Obs.)	1519	1847	
employment nace h+j	56375	56375	0
(Obs.)	1850	1850	
employment nace i	49546	47876	1670
(Obs.)	1489	1847	
employment nace l+m+n	107967	107967	0
(Obs.)	1850	1850	
employment hours	38.83	38.79	0.03
(Obs.)	1800	1850	
gross fixed capital formation	11529.93	12121.45	-591.51
(Obs.)	1402	1590	

Notes: Table reports mean comparison between raw and imputed data from the regional statistics. Significance: ***0.01 , **0.05, *0.10.

Table A3: Variable Description

Variable	Standardization	Description	Unit	Alternative Measures Used
Standardization Variables				
pop_tot		total population	number	
area_tot		total area	1k ha	
eact_ue15		economically active population over 15	thousands	
empl_nace		employment in nace industries	number	
Outcome Variables				
gdp_pc	population	Gross Domestic Product	millions Euro	deflated, PPP
disp_hhinc_pc	population	Disposable Household Income	millions Euro	deflated, PPP
gva_pc	population	Gross Value Added of all NACE industries	millions Euro	deflated
wage_pc	population	Wages of all NACE industries	millions Euro	deflated
patents_pc	population	Patent applications to the EPO	number per 100 capita	
Explanatory Variables				
sh_for_cit	population	share of foreign citizens	share	Foreign born, foreign migrants
theil		Theil Index	index value	12 foreign groups
herf		Herfindahl Index	index value	12 foreign groups
Fixed effects				
year		calendar year	dummies	
country		country a region belongs to	dummies	
demographic controls				
pop_dens	area	population density	No. per ha	
sh_pop_fem	population	share of females	share	
sh_pop_15_64	population	share of working age population	share	
sh_pop_ue65	population	share of retirement age population	share	
netmig_rate	population	net migration rate	(immigrants-emigrants) per capita	

Table A3 (continued): Variable Description

Variable	Standardization	Description	Unit	Alternative Measures Used
qualification controls				
share low qualification (omitted)	eact_ue15	economically active population with low education	share	
share medium qualification	eact_ue15	economically active population with medium education	share	
share high qualification	eact_ue15	economically active population with high education	share	
economic structure controls				
firm structure	empl_nace	firms per worker	number of firms/number of employees	
empl_nace_b	empl_nace	employment in mining and quarrying	share	
empl_nace_c	empl_nace	employment in manufacturing	share	
empl_nace_de	empl_nace	employment in energy & water supply	share	
empl_nace_f	empl_nace	employment in construction	share	
empl_nace_g	empl_nace	Employment in wholesale and retail trade	share	
empl_nace_i	empl_nace	Employment in hotels and restaurants	share	
empl_nace_hj	empl_nace	Employment in transport, storage and communication	share	

Table A3 (continued): Variable Description

Variable	Standardization	Description	Unit	Alternative Measures Used
input factor controls				
capital	population	accumulated gross fixed capital formation (5 years)	millions euro per capita	
labor	population	employment share 15-64 years	share	
hours		average weekly working hours	number	
r&d specific controls				
r_d_expend	population	r&d expenditures	millions euro per capita	
r_d_employees	population	r&d employees (full time equivalent)	share	

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Project Information

Welfare, Wealth and Work for Europe

A European research consortium is working on the analytical foundations for a socio-ecological transition

Abstract

Europe needs change. The financial crisis has exposed long-neglected deficiencies in the present growth path, most visibly in the areas of unemployment and public debt. At the same time, Europe has to cope with new challenges, ranging from globalisation and demographic shifts to new technologies and ecological challenges. Under the title of Welfare, Wealth and Work for Europe – WWWforEurope – a European research consortium is laying the analytical foundation for a new development strategy that will enable a socio-ecological transition to high levels of employment, social inclusion, gender equity and environmental sustainability. The four-year research project within the 7th Framework Programme funded by the European Commission was launched in April 2012. The consortium brings together researchers from 33 scientific institutions in 12 European countries and is coordinated by the Austrian Institute of Economic Research (WIFO). The project coordinator is Karl Aiginger, director of WIFO.

For details on WWWforEurope see: www.foreurope.eu

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