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How did Regional Economic Structures in the EU Change during the Economic Crisis?

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Directorate-General for Economic and Financial Affairs

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Abstract

10 years on, many countries and regions in the EU still bear the scars of the 2008/2009 financial crisis. Countries and regions have recovered at different rates and undergone different structural changes. While the asymmetric impact of the crisis across regions and sectors has had a short-term impact on concentration and specialisation patterns; long-term forces, such as global economic and supply chain integration, continue to shape the economic landscape of European regions.

In our empirical analysis, we describe the development of regional economic structures in terms of sectoral employment and production (gross value added) during the crisis. We focus on the location pattern of sectors (concentration), i.e. in which regions economic activities in a sector tend to be located, and the specialisation of regions, i.e. which sectors are particularly important in a region.

Our analysis shows that the impact of the crisis on overall specialisation patterns appears rather limited, although some regions have been more affected than others. In addition, the general trend of sectoral location patterns in the EU becoming more similar over time has continued, albeit at a slower pace since 2009, especially in Central and East European Countries. In terms of sectors, employment and production concentration in the construction and manufacturing sectors, which displayed clustering before the crisis, have been dispersing since 2009. The data also show that regions with large employment losses during the crisis were mainly specialised in agriculture, low-tech manufacturing, construction and less-skilled services such as trade, accommodation/restaurants and transport. This suggests that local economic structures may have played a role in the economic resilience of regions during the crisis.

JEL Classification: F02, F14, F21, L6, O57, P52, C43, F15, N60, R12.

Keywords: regional specialisation, sectoral concentration, location of economic activity, European economic integration, economic crisis.

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CONTENTS

LIST OF TABLES

LIST OF GRAPHS

1. INTRODUCTION

The 2008 financial crisis was felt differently across Europe's regions and economic sectors. The global financial and economic crisis abruptly changed economic conditions, as investment and global trade dropped sharply and financing conditions started to vary more from country to country. While financing became easier for countries perceived as having strong public finances and their stronger corporates, access to finance became more difficult for other countries and companies. Also, unsustainable developments during the build-up to the crisis in some areas like housing and real estate came to the fore. Most regions in the EU were adversely affected by the economic developments that began in 2008. Overall, in the EU28, real GDP contracted by 4.4% in 2009 and the unemployment rate increased by 3.8 pps., to almost 11% in 2013, the last year covered by our data set. However, the impact of the crisis largely differed across regions, both between and within countries. In some regions of Greece, unemployment rose by up to 20 pps. between 2008-2013, while in parts of Germany, it fell from 9% in 2007 to an average of less than 5.5% in 2013. Regions in Spain and in Greece recorded unemployment rates of more than 25% in the five year period after the crisis. Certain economic activities, including construction and manufacturing, were particularly hit by the crisis with much larger losses in employment and gross value added than in other sectors, such as business services.

This paper provides a comprehensive overview of the location of economic activities in the EU between 2000 and 2013. The main focus is on regional specialisation and sectoral concentration. We calculate three alternative indices of specialisation and concentration. This paper covers, depending on the data set used, production (gross value added, GVA) and employment in up to 268 regions in all EU Member States broken down into up to 52 sectors covering all economic activities over the period 2000 – 2013, using the same calculation method for all indicators/sectors/regions. Describing the developments of these indicators provides a comprehensive analysis of specialisation and concentration trends in the EU over the time period concerned. It allows us to observe the general trend before and changes during the crisis years. As this empirical paper focusses on a general overview, we do not provide a specific counter-factual analysis distinguishing between short-term effects (due to the crisis) and long-term effects (globalisation, structural change, economic transition etc.).

How did concentration and specialisation patterns in the EU change during the crisis? Did highly specialised regions suffer most during the crisis? Are there differences between high-tech and low-tech oriented regions? Did public sector employment provide a buffer, or was this not possible because of fiscal consolidation? Did the crisis result in a more homogenous share of construction employment across Europe? Did industry (in this paper excluding construction) become more concentrated? These are some of the questions we address in this paper with a comprehensive description of concentration and specialisation developments in the EU during the economic crisis. While these developments are influenced by a wide range of factors including cyclical trends, technological change or globalisation, our analysis shows abrupt deviations during the crisis years from stable longer-term trends. These changes are thus likely due to the economic and financial crisis as well as policy measures undertaken at the time.

This paper is structured as follows: first, we briefly review the existing literature on specialisation and concentration; second, we describe our data sets and applied indicators; third, we present our empirical results and describe the specialisation and concentration patterns, focusing on the impact of the crisis since 2008/2009 on the regional economic structures of the EU; finally, we summarise our main conclusions.

2. REVIEW OF THE EMPIRICAL LITERATURE

The literature so far does not give a clear indication of a specialisation or diversification trend during times of crisis. Neither economic theory like new economic geography nor the various strands of empirical analyses can explain or fully describe how economic downturns influence the long-term structural processes of regions. Giving a short historical background: with the emergence of the new economic geography models in the 1990s empirical studies analysed regional specialisation and geographical concentration developments on a longer-term basis, e.g. regarding the impact of economic integration processes. Since these studies are analysing different regions/countries based on different economic variables, results come to differing conclusions concerning the impact of economic integration processes like in the EU. An analysis by some of the current authors (Stierle-von Schütz and Stierle, 2013) showed that absolute and relative regional specialisation was decreasing slowly in EU15 up to 2008 indicating some structural convergence. Central and Eastern European countries (CEE) experienced a more pronounced trend towards converging regional economic structures during their transformation process and the integration in the European Union. In turn, sectors are showing diverse concentration outcomes in these studies, depending on the importance of agglomeration externalities and the overall stage of economic development (e.g. Bickenbach et al., 2010, Stierle-von Schütz and Stierle, 2013([2]).

Recent studies confirm that global events like the economic crisis have a diverse impact on local entities and can change the economic landscape, specialisation and concentration patterns considerably. This change is not distributed equally between local units, being firms, employed persons, regions within countries or sectors. Research has focused on the crisis/recession impact on different structural economic variables, e.g. *sectoral (un)employment* (Blažek and Netrdová 2012, Marelli et al., 2012, Stehrer et al., 2012, Gabe et al., 2013), *production patterns* (Havlik, 2014) or *specific sectors* (OECD 2009, Gardo and Martin, 2010; European Commission 2010, Martin, 2012) in a set of countries or in individual countries/regions/cities([3]). Due to the specific factors triggering and transmitting the crisis (e.g. housing bubble with mortgage crisis, drop in private consumption and trade linkages), it seems evident that regions and sectors mainly active in these areas were the most hit (Martin, 2011). It could be expected that, specialised regions with a high concentration of the financial sector, but also construction and manufacturing of investment goods as highly business-cycle sensitive sectors would be most affected in the short-term. This will be further analysed in section 4.

The recently emerging literature on regional resilience is frequently using indicators of economic structures as determinants of a region's capacity to cope with shocks and recessionary downturns([4]). As already shown by Dissart (2003), Ormerod (2010) and Siegel et al. (1995), economic sectors differ in their development during cyclical economic fluctuations. Groot et al. (2011) show that the sectoral business cycle sensitivity explains a substantial part of the GDP change during the crisis in EU15 countries and regions. Their indicator of sensitivity calculated between 1980 and 2003 indicates that manufacturing sectors are more sensitive to business cycle movements than services sectors, what had implications for the regional economic performance during the recent downturn.([5]) Analysing the sensitivity of regions by taking indicators of resilience and shares of different sectors into account, Davies (2011) found rather inconclusive results – regions' resilience capacity was linked to strong and weak regions before the crisis and depended on the respective country performance. Specialised regions might be less vulnerable to shocks if and only if their specific sector is not affected. Diversified regions, although facing a higher probability of being hit by a shock, might accommodate and disperse the downturn easier than a specialised region where the main sector and therefore a large part of the regional economy would be affected (Boschma, 2015). In a recent study on the resilience of Spanish regions,

([2]) See also both references for a more extensive overview of regional specialisation and industrial concentration studies.
([3]) For a set of relatively early studies on Central and Eastern European countries see e.g. Gorzelak and Goh (2010), Kiss (2012) on Hungary, Townsend and Champion (2014) on British Cities, Lagravinese (2015) on Italy etc. More recent country studies can be found in the special issue of the Cambridge Journal of Regions, Economy and Society on "The Economic Crisis in Europe: Urban and Regional Consequences, 2016 Volume 9(1).
([4]) See on resilience for example the Regional Studies special issue edited by Bailey and de Propris (2014), Martin (2010) or Reggiani et al. (2002).
([5]) This had been confirmed by Maroto-Sánchez (2012) for Spanish regions.

Cuadrado-Roura and Maroto (2016) argue that Spanish regions specialised in dynamic and productive sectors as manufacturing, energy and some market services proved to recover quicker in terms of economic growth than regions specialised in extracting and primary activities.

A different strain of literature analyses the adaptability of regions, emphasising the dynamic pattern of resilience. The results of more recent studies show that the impact of diversity/specialisation does not only depend on the sectoral composition of the regions but also on other factors, like institutions, relations between local industries (variety) or trade linkages. While the initial resistance after a shock is rather linked to the regional embeddedness and the relationship between local units, during the following phase the adaptability is related to the economic structures of the region and the so-called industry relatedness (Eriksson and Hane-Weijman, 2015). Diversified regions might have a potential to combine related industries with similar knowledge and to develop new opportunities for the work force and firms (Frenken et al., 2007). Consequently, regions where industries and sectors are not related might face difficulties in providing laid-off workers new jobs. The existing economic structure, the industrial history but also the inter-sectoral linkages are therefore important for the regions' capacity to find a new growth path after an economic downturn (Essletzbichler, 2015, Boschma 2015). A key challenge for empirical research on relatedness lies in the availability of relevant sectoral data – depending on the sector definition, a region could be specialised or even diversified – as well as data on interconnectedness with other sectors. In this paper in turn, we describe key developments of relative and absolute indicators in order to compare regions/sectors within the EU during the crisis without considering the relatedness of industries.

Further research also links the dynamic resilience pattern with effects of agglomeration externalities and shows that location externalities are beneficial for regional crisis resilience. Brakman et al. (2015a) analyse urbanisation and specialisation pattern in 255 European NUTS2 regions between 2008 and 2012 as determinants of regional resilience in terms of unemployment and GDP growth. They show that in the beginning especially the food sector had a dampening impact on unemployment, while from 2010 agriculture-intensive regions showed higher unemployment. Taking the urban structures into account, the so-called commuting regions with mobile labour force with a high output share of medium-high technology and financial and business sectors show relative resilience during the recession. This result is similar to the analysis of cities during the crisis by Capello et al. (2015), where cities and surrounded regions show a better economic performance during the crisis due to the quality of infrastructure and other production factors, external linkages and networks. Since these urban sectors might be specialised in exporting activities Brakman et al. (2015a) infer that export sectors would be less vulnerable to a recessionary downturn. This result can also be found in Martin et al. (2013) where regions with clustering export firms close to cities sustained the crisis better than other areas. However, in contrast to what these papers assume, during the recent crisis especially trade volumes have been reduced substantially.

Regional specialisation patterns are found to be influenced also by trade in goods/services and the regional division of functions along global value chains (GVC) with firms choosing their location according to local comparative advantages in a specific production stage. As a reaction of global competition and technological progress, firms started to split their production process between different regions according to local comparative advantages. Trade in intermediate goods and services, or trade in 'tasks' became more and more important, especially for manufacturing sectors (Stehrer et al. 2012b, Galar, 2012). This international fragmentation process might have an impact on the regional production structures (Baldwin and Evenett, 2015). Location decisions of firms are made according to the different stages of the fragmented production process. Agglomeration economies, forward and backward linkages are not only becoming important for sectors and industries, but for production stages (Baldwin and Venables, 2013, 2015). So far, empirical analysis is only at the starting point (Brakman and Van Marrewijk, 2017). In their general macroeconomic analysis using the world input output tables of the WOID-project Timmer et al. (2014) observe that more developed countries are rather specialising in high-skilled labour which might not always be the core activity of the manufacturing sector but related

activities as design, marketing, distribution or sales([6]). Coming to a similar conclusion, Borowiecki et al. (2012) as well as Sass and Szalavetz (2014) infer from their empirical research that manufacturing industries in advanced economies tend to specialise in activities which are associated with a higher value added, i.e. business and product concept, R&D, design (in the beginning of the value chain) and service oriented activities as marketing, sales, after-sales services (at the end of the value chain). These results suggest that specialisation/concentration patterns would be rather observed in the distribution of functions and activities within industries and firms rather than through the overall distribution of industries and sectors. In this paper, we are looking at the overall distribution of sectors since we are interested in the developments of all economic activities on a regional level, not only the manufacturing sector. Data on functions within industries and even trade data are rarely available on a sub-regional level([7]) and the identification of this type of specialisation is even harder to detect than the "traditional" sectoral concentration (Brakman et al., 2015b). Linking the discussion on regional specialisation / sectoral concentration and the role of foreign direct investment (as another indicator of the international production process) in an enlarged EU, Vechiu and Makhlouf (2014) find a positive impact of FDI on a country's relative specialisation in manufacturing and for economic sectors at a whole in a first stage of development. In a second stage, FDI seem to affect specialisation negatively. However, for the Central European Economies, this reasoning seems to be reversed, which might be due to the catching-up process and re-organisation of these economies. In times of recession, these international producers might move or even close down part of the production, which would in turn impact the local economic structure.

Summarising, recent studies on the crisis impact focus mainly on analysing the resilience of regions. In these studies, the economic structures are used mainly as a determinant (Martin et al. 2016) but not studied in their developments. This empirical analysis is describing the trends during the last economic crisis.

([6]) This finding would even support the so called Stan Shih smile-curve, relating value added to every production stage with core manufacturing activities being considered as providing the lowest value input (Baldwin and Evenett, 2015).

([7]) Bode and Cutrini (2015) are analysing the pattern of key functions in manufacturing and how the spatial distribution of these functions changed between 1992 and 2007.

3. DATA AND MEASURES

Various employment and gross value added data sets allow for a different regional and sectoral disaggregation up to 2013. We use employment data from the labour force survey (LFS), the branch accounts (BA) and the structural business statistics (SBS) to construct panel data sets on the evolution of sectoral employment at the detailed regional level (NUTS-2). Furthermore, the branch accounts also contain information on the evolution of gross value added. This is used to construct a panel data set on gross value added per sector at the regional level. All data are extracted from the EUROSTAT regional database, and in a few cases complemented with national data sources. Table 1 gives an overview over the various data sets we use for our analysis. They range from 2000 to 2013([8]) and cover all EU member states.([9]) Depending on data availability across the different sources, the number of regions covered by our analysis ranges from 242 up to 268. The sectoral breakdown varies from 7 to 52 sectors.([10])

Table 3.1: **Overview Data sources**

Data source	Area	Regions	Sectors (1)	Time
Employment				
LFS	EU-28	NUTS-2 (268 regions)	7 (NACE A-U)	2008-2013
BA	EU-27	NUTS-2 (266 regions)	8 (NACE A-U)	2000-2011
SBS	EU-27	NUTS-2 (242 regions)	52 (NACE B-N (excl. K))	2008-2011
Gross value added				
BA (2)	EU-28	NUTS-2 (268 regions)	8 (NACE A-U)	2000-2011

(1) Table A.2 in the Annex provides an overview of the sector disaggregation according to NACE Rev. 2.
(2)As the branch accounts report gross value added in current prices, we use sectoral price deflators to deflate the series.
Source: Eurostat

For our analysis we calculate commonly used indicators for measuring specialisation and concentration. In the empirical literature a number of indicators are used to measure sectoral specialisation of regions and geographical concentration of sectors. All indicators have advantages and shortcomings.([11]) All values of the indicators are highly dependent on the level of regional and sectoral disaggregation. The more detailed the analysed dataset is in terms of regions and sectors, the higher are the absolute values of the calculated indicators. This is simply due to the fact that using less disaggregated data averages out differences between sectors and regions and results in lower index values([12]). Therefore, comparing levels of the indicators should be done with care. Evolution of the indicators over time is more straightforward.

We use different indices to analyse the data: the Theil index, the dissimilarity index, the Herfindahl index and the location coefficient. For our analysis, we will mainly rely on the Theil index and use the other indicators for a robustness check.

The Theil index *T* is calculated as follows:

$$T_j = \sum_{i=1}^{I} x_{ij} \ln\left(\frac{x_{ij}}{x_{i\bar{j}}}\right) \quad (1)$$

([8]) This time frame is constrained by the new European System of National Accounts, ESA2010 which introduced inter alia a new disaggregation of industries.
([9]) However, information on employment for the most recent member of the EU-28, Croatia, is not available at the detailed NUTS-2 regional level in all data sources. Furthermore, we do not include extra-territorial regions and overseas departments (e.g. in the case of France). Lastly, SBS of Eurostat do not include regional data on employment for all French regions.
([10]) See the Annex for a detailed overview of the regions and sectors.
([11]) For an overview see e.g. Stierle and von Schütz (2003), Combes and Overman (2004), or Bickenbach and Bode (2008).
([12]) See Stierle-von Schütz and Stierle (2013) for a more in-depth discussion.

To calculate the employment (resp. production) specialisation index, the employment (resp. gross value added) share of sector *i* in region *j* is denoted by *xij* in equation (1). The higher the index value, the higher is the degree of specialisation of the region relative to the benchmark distribution, which is usually the average distribution of the whole area $x_{i\bar{j}}$ (here the European Union).

Analogously, the employment (resp. production) concentration index can also be calculated based on the formula in equation (1). In this case, the employment (resp. gross value added) share of region *i* in sector *j* is denoted by *xij*. The lower bound of the Theil index equals zero, i.e. all sectors would have the same sectoral/regional share of employment (resp. production) vis-à-vis the benchmark distribution of the respective sector. There is no upper bound.

Using the same notation, the formula of the dissimilarity index *D* is:

$$D_j = \frac{1}{2}\sum_{i=1}^{I}\left|x_{ij} - x_{i\bar{j}}\right| \quad (2)$$

The dissimilarity index *D* ranges from zero, when no specialisation (resp. concentration) is observed, to one in case of full specialisation (resp. concentration).

The third indicator is the Herfindahl index *H*. It is calculated as follows, using consistent notation:

$$H_j = \sum_{i=1}^{I}(x_{ij})^2 \quad (3)$$

The Herfindahl index values have 1/I as lower bound and the index equals one in case of full specialisation (resp. concentration). The lower bound of the Herfindahl index, however, has no meaningful economic interpretation. In the case of calculating the degree of specialisation, it would just indicate that all sectors under analysis have equal employment (or production) shares. This statistical artefact is not present in the indicators above, since those are relative indices comparing to average degrees of specialisation or concentration.

Finally, the location coefficient *L* expresses the importance of a particular sector in a region as an additional indicator for the regional production structure. The ratio $\frac{x_{ij}}{x_{i\bar{j}}}$ has a relevant economic interpretation and is referred to as the location coefficient *Lij*. A ratio equal to 1 would indicate that the particular region *j* has a similar share of employment (resp. production) in sector *i* as the average region $\bar{j}$. A lower value would indicate this share is smaller than on average, and vice versa for a higher value above one.

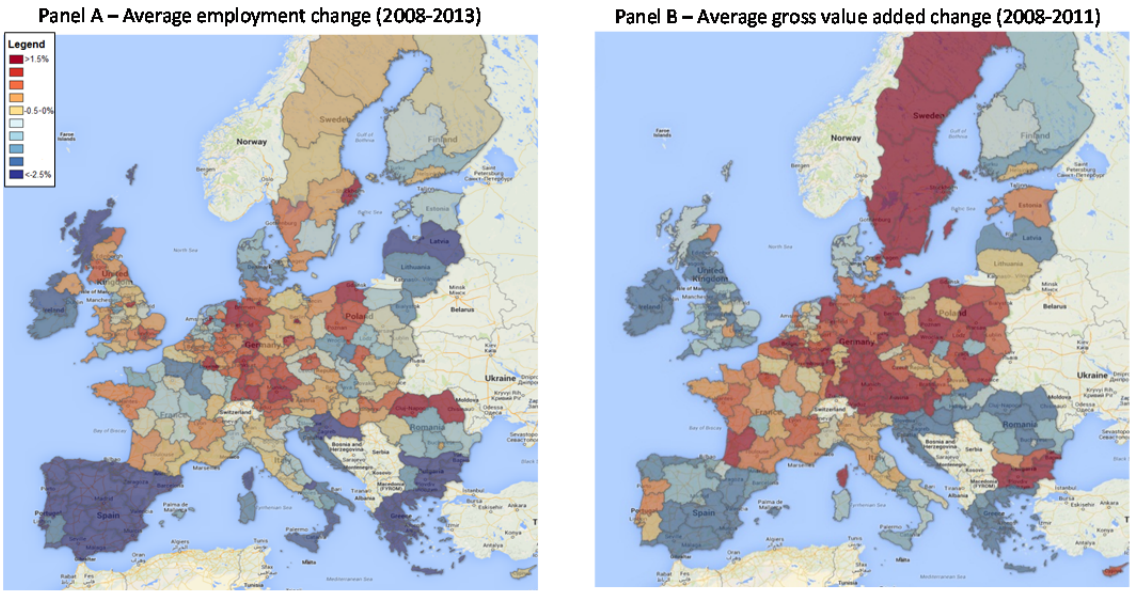
4. DEVELOPMENT OF THE ECONOMIC STRUCTURES OF EUROPEAN REGIONS SINCE THE CRISIS

4.1. General developments and the effect of the initial regional structure

General developments

The regions in the EU were adversely affected by the economic crisis with employment reductions being concentrated in peripheral European countries, while production decreased considerably also in western and northern regions. Particularly regions in Southern Europe experienced large reductions in employment over the period 2008-2013 (see Graph 4.1.1, Panel A) as did some regions in Central and Eastern Europe as well as in Ireland and Scotland. However, in terms of gross value added partially different regions faced relatively large difficulties, especially in the UK, Denmark and Finland (see Graph 4.1.1 Panel B). In turn, some regions faired relatively well, in particular regions in Sweden, Germany and Poland. However, the chosen time frame seems to be decisive for this analysis. While up to 2010 production in Germany fell more than the average EU GDP, a rather stable employment rate led to strong decline in German productivity and hours worked. With support of government policies and in agreement with trade unions, hours worked had been reduced substantially (short-time working arrangements). As from 2011, however, production in Germany has increased strongly again. Furthermore, the impact of the crisis did not only differ between countries, but also between regions within countries.

Graph 4.1.1: **Regional impact of the crisis in terms of employment and GVA growth**

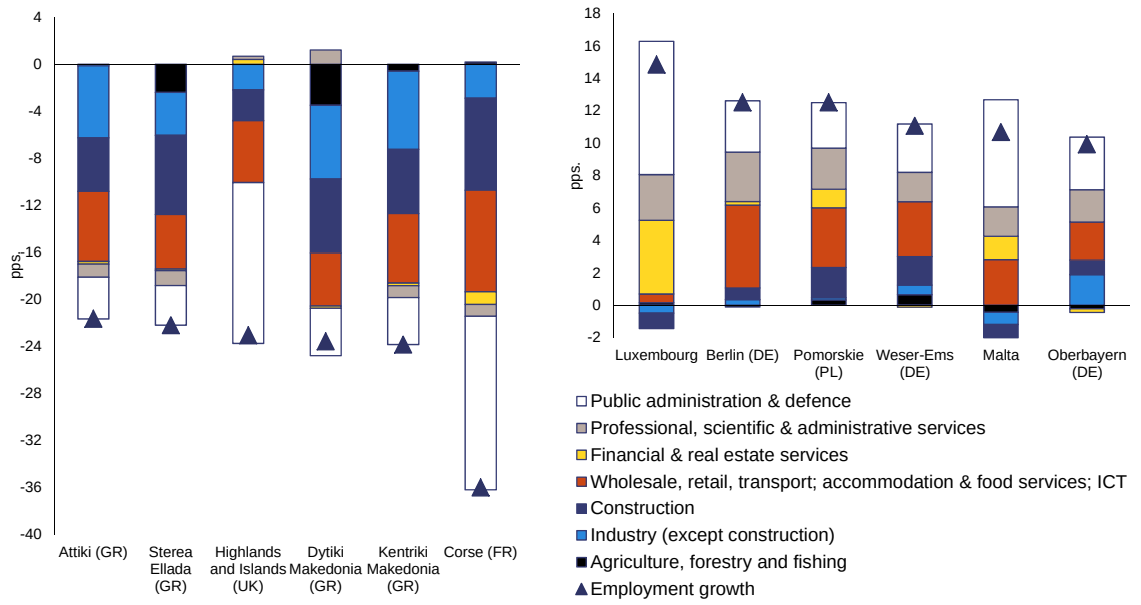


Source: Eurostat

The impact of the crisis was also disparate across sectors with the construction and the industry sectors being most affected by a considerable decline in employment and production. The financial crisis started as an acute crisis of the banking system and quickly affected the construction sector, in

particular in Greece, Ireland, Portugal and Spain([13]). Employment in construction decreased by 17% between 2008 and 2013 in the EU, while regional employment in this sector even went down by 68% in Andalucía (Spain), by 63% in the Algarve (Portugal) or 59% in West Ireland in this period. Spanish regions represented nearly 40% of the dropdown in construction employment. The economic crisis also caused a slump in demand particularly affecting the industrial sector which shrank by 12% between 2008 and 2013. Here, especially the manufacturing of investment goods or durable consumer goods (car industry) sectors suffered. Again, Spanish regions recorded the highest drop in employment: nearly 20% of the total industry employment reduction occurred in Spain. This stands in contrast to the development in the non-market services and the business and financial services, where output and jobs developed similarly and even increased in some regions. Stehrer et al. (2012a) showed that these sectoral developments were also visible in previous crises. However, also these sectors suffered from a protracted weak economy. From an overall view on employment loss, the following graphs (4.1.2) shows the best performing regions with an increase in overall employment, and the least performing regions, with substantial losses in overall employment, including the growth contributions of different sectors. Employment growth in the above average performing regions was mainly driven by employment in public administration as well as sales, food & ICT sector. In regions with shrinking overall employment, public administration jobs were cut as well as jobs in agriculture, industry and construction sectors.

Graph 4.1.2: **Sectoral employment performance in regions with below (left-hand panel)/above (right-hand panel) average employment development (low/high performing regions respectively, 2008-2013)**



Source: Eurostat

In the remainder of the section the diverse developments in employment and gross value added across Europe and their impact on concentration and specialisation patterns in the EU are discussed. In order to better understand the changes in specialisation of regions and the concentration of sectors across the EU, we first group the regions according to their economic performance over the crisis to see if regions within each group have similar initial economic structures, which could explain if they would adapt to the crisis more easily and which faced more challenges. Next, we are interested in the developments of specialisation and concentration over time. Did the crisis have stronger implications for specialised regions? Which specific sectors were particularly affected by employment and production

([13]) The specific vulnerability of these regions due to the build-up of an inefficient resource allocation in the years before the crisis might be caused by diverse demand and supply factors, see e.g. Kapelko et al. (2014), Royo (2009), Cuerpo and Pontuch (2013).

downturn during the crisis? Did this ultimately lead to higher specialisation of regions in certain economic activities? Or on the contrary, did the economic structures of regions converge across the EU? Lastly, we investigate whether specialisation and concentration developed differently and/or at a different pace according to the economic performance of the region.

Relation between regional growth during the crisis and initial sectoral specialisation

Employment developed heterogeneously during the crisis and regions can be grouped according to their growth patterns between 2008 and 2013. To analyse this effect, we create four groups (quartiles) of regions based on their average employment growth in the period 2008-2013. The 25% regions with lowest employment growth are group 1 (lower quartile). The 25% regions with the highest employment growth are in group 4 (upper quartile). The other regions are divided into the lower interquartile and upper interquartile using the median value as splitting point. Average employment growth in these groups is summarised in the following table:

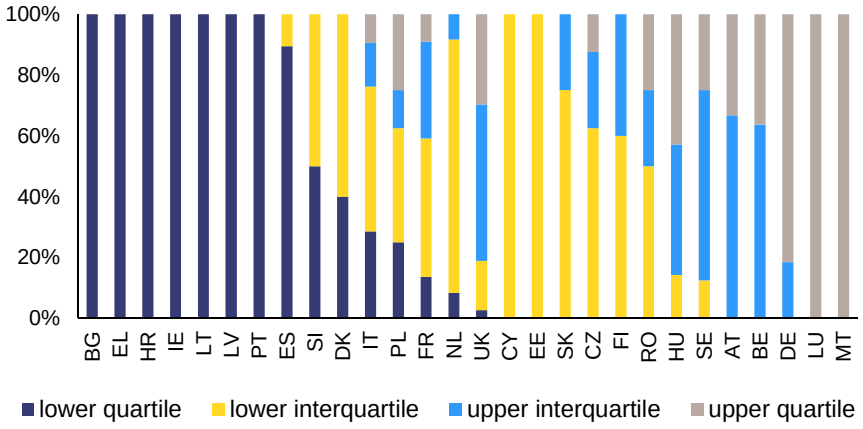
Table 4.1.1: **Average annual regional employment growth in period 2008-2013**

	Min	Median	Max
lower quartile	-7.7%	-2.9%	-1.6%
lower interquartile range	-1.6%	-0.9%	-0.4%
upper interquartile range	-0.4%	0.0%	0.4%
upper quartile	0.4%	0.9%	2.8%

Source: Labour Force Survey and own calculations, a list of regions belonging to the different quartiles can be found in table A3 in the Annex.

Before the crisis, regions in the lower quartile showed a very dynamic employment evolution. Average annual employment growth in these regions was at 2.1% between 2000 and 2007 while the upper quartile regions only grew on average 0.5%. The dynamic in the lower quartile regions was mainly driven by employment growth in construction, basic services (as trade, tourism, communication) and business services. As mentioned earlier, inefficient resource allocation might have been built up. During the crisis years, the trend in these regions reversed and these same sectors, as well as the industrial sector contributed to the poor labour growth performance.

Graph 4.1.3: **Regional employment growth in 2008-2013**



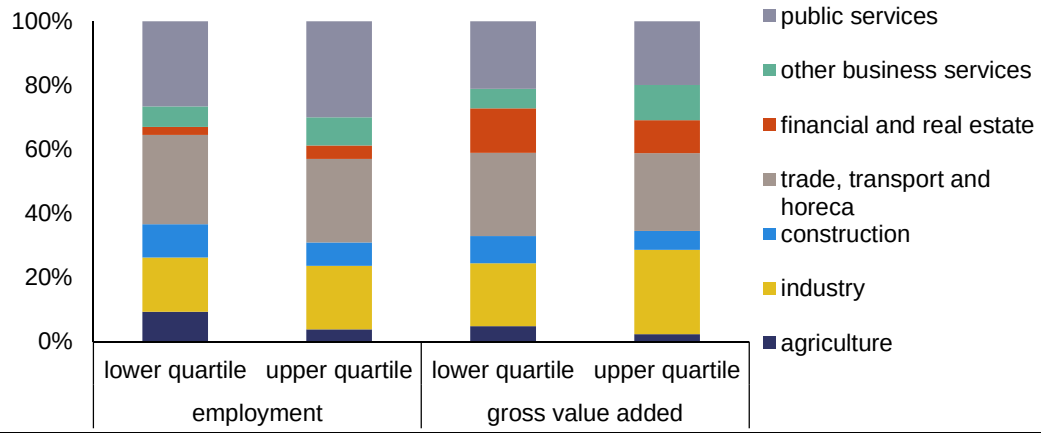
Source: Labour Force Survey, own calculations

The post-crisis period is characterised by low job creation in most EU regions. Between 2008 and 2013, average annual regional employment growth in the EU was equal to -0.7% y-o-y. However, some regions succeeded to create jobs in net terms during this period, notably Malta, Luxembourg and regions in Germany. In other countries such as France, Italy, the Netherlands, Poland or the UK, the regional performance was divergent with some regions increasing and others reducing employment (see Graph 4.1.3).

Gross value added (GVA) in most regions evolved similar to changes in employment. According to the groups defined above, we find that gross value added decreased on average with 1.6% y-o-y in the lower quartile regions. Also, in the most performing regions, in the upper quartile regions, production growth was weak, but still positive at 0.3% y-o-y. The correlation between employment growth and growth in gross value added is statistically significant with a 1 pp higher average change in employment being associated with a 0.5 pp higher increase in average gross value added growth. In other words, a stronger increase (decrease) in gross value added coincided with a larger increase (decrease) in employment in that period. This statistical correlation was much stronger for EU-15 regions (t-value = 8.75) than for regions in Central and Eastern Europe (t-value = 1.98, see Graph A.1 in the annex). This difference might be due to a higher labour intensive production in the CEE, potentially allowing for stronger changes in labour productivity.

The sectoral structures of regions at the beginning of the crisis differed between regions in the lower and the upper employment growth quartile. *First*, the employment share in agriculture is more than twice as large in the lower quartile (9.3%) than in the upper quartile regions (3.8%). The share in total gross value added of the agricultural sector is, however, much lower with 4.8% in the lower quartile vs. 2.3% in the upper quartile. This indicates the low labour productivity in this sector compared to other sectors and even the difference between the lower quartile regions compared with regions in the upper quartile. *Second*, the industry share (sectors C-E, i.e. excluding construction) in total gross value added equals 26% in the upper quartile regions. This is 6.7 pps. larger than in the lower quartile where it is less than 20%. The upper quartile regions also employ 3 pps. more of their total workforce in industrial branches than in the lower quartile. Hence, labour productivity in industry is higher in the upper than in the lower quartile. *Third*, regarding the construction sector, this sector was more important in low-growth regions in 2008, both in terms of employment (10.4% vs 7.3%) and in gross value added (8.5% vs 5.9%). A lower share in total gross value added than in total employment indicates that labour productivity in this sector is also relatively low. *Fourth*, high skill services, which might be linked to agglomeration externalities, such as professional, scientific and technical services are relatively important in the upper quartile, while services that require less skills (e.g. trade, transport as well as accommodation and food services) employ a relatively large share of the labour force in low-growth regions (see Graph 4.1.4).

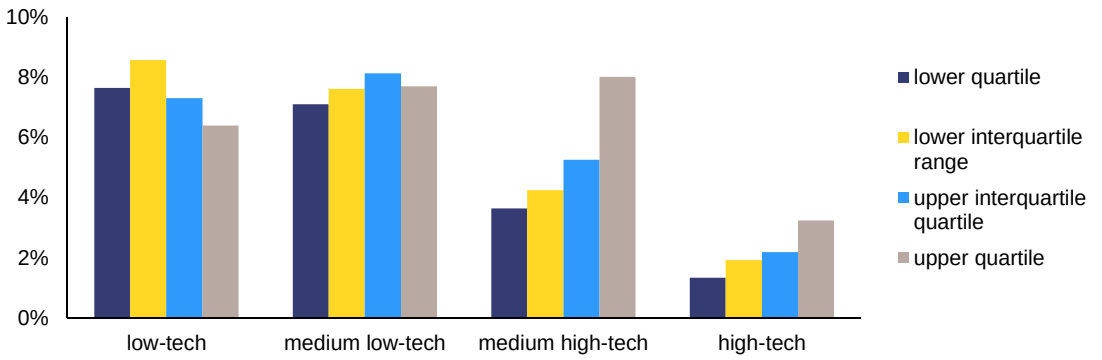
Graph 4.1.4: **Sectoral structure in 2008 of regions with worst (lower quartile) and best (upper quartile) employment growth**



Source: Labour Force Survey (employment), Branch Accounts (gross value added), own calculations

Upper quartile regions benefited from a strong high-tech manufacturing, especially in the EU-15. The aggregated numbers of the manufacturing sector might hide important information on structural change within the sector. We therefore also consider the division in high- and low-tech industries. Graph 4.1.5 shows that in the EU-15 the industrial sector in high-performing regions is oriented towards medium-tech and high-tech manufacturing.([14]) This may explain why the overall labour productivity in industrial sector is higher in these regions. Regions with negative employment developments were relatively dependent on low-tech manufacturing. On the other hand, regions that managed to create jobs in net terms had a relatively large high and medium high-tech manufacturing. In CEE regions, these differences are smaller but still visible.

Graph 4.1.5: **Regional industrial employment share in EU-15 according to technology (2008)**

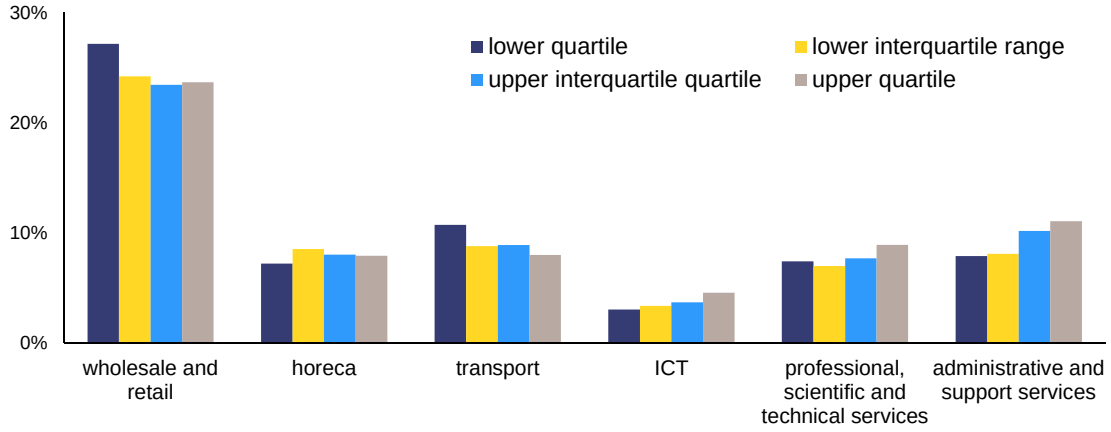


Source: Structural Business Statistics, own calculations

Similarly, in the EU-15 high skill service sectors like professional, scientific and technical activities are more prominent in regions with above average employment growth since 2008. The share of six broad categories of services in total employment is displayed in Graph 4.1.6 according to the economic performance group of the region. Regions in the lower quartile are more oriented towards sectors which are less skill intensive (e.g. wholesale, retail, accommodation and food services, as well as transport) than regions in the upper quartile. In the latter, the share of high skill services employment (like ICT, professional, scientific and technical services) is higher. Again these differences are less pronounced in CEE.

([14]) See Table A.2 in the Annex for more information on the definition used here of low-, medium- and high-tech sectors.

Graph 4.1.6: **Regional service employment in EU-15 (2008)**

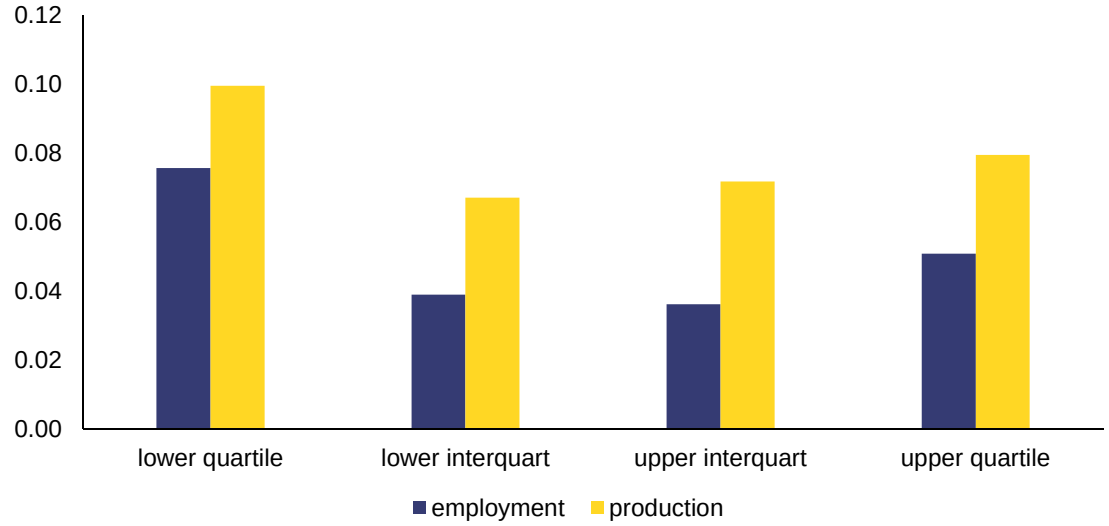


Source: Structural Business Statistics, own calculations

A high degree of specialisation is common for both, regions with relatively good and with rather unfavourable employment growth. Graph 4.1.7 shows the average Theil index of employment and production specialisation for each quartile. A U-shaped form is visible with employment and production specialisation being relatively high for the lower and upper quartile and rather low for the interquartile regions. This indicates that the economic structures of the upper quartile and the lower quartile diverge from the average regional economic structures in the EU([15]). Therefore, from our observations it cannot be concluded that a high specialisation per se was harmful for regions, but this depends in which sectors a region was specialised. We found that low growth regions in the period 2008-2013 were rather reliant on less skill intensive sectors as agriculture, low-tech manufacturing, and services in hotel, restaurants, catering and trade. Furthermore, we found that high growth regions were more specialised in medium- and high-tech manufacturing, as well as skill-intensive services such as professional, technical and administrative support services. As we will show in the next section (see 4.2.2), the lower quartile regions have profited from specialisation gains before the onset of the crisis with large employment increases in low-skill sectors.

([15]) In a study on US metropolitan regions, Kemeny and Storper (2015) found that specialisation in tradable sectors was linked to regional urban development in terms of wage growth between 1998 and 2010.

Graph 4.1.7: **Employment and production specialisation in 2008 (Theil index)**



Source: Labour Force Survey (employment), Branch accounts (gross value added) and own calculations

4.2. DEVELOPMENT OF THE REGIONAL ECONOMIC STRUCTURES AFTER THE CRISIS

Concentration and specialisation patters changed noticeably during and after the crisis. Employment and gross value added developed unevenly across regions in the EU. In addition, as shown in the previous section we found that the initial sectoral structures of regions less affected by the crisis were markedly different from those which suffered the most. Thus, probably mainly as a result of the crisis, the sectoral specialisation of regions and the geographical concentration of sectors in the EU may have changed substantially.

Regional Specialisation

To analyse the evolution of regional specialisation, we are trying to detect possible divergence / convergence tendencies within different geographical units (EU as a whole and EU-15 vs. CEE). The transition of the CEEs and the harmonisation process in the EU may have resulted in different specialisation and concentration developments between EU-15 and the CEEs. Therefore, we present our findings for the EU as a whole, and, where most relevant, also for both the EU-15 and the CEEs separately. Furthermore, we discuss both specialisation in terms of employment (employment specialisation) and in terms of gross value added (production specialisation).

As described before, employment specialisation in the EU decreased since the early 2000s, but this trend came to a halt in 2008. The employment structure of regions within the EU became increasingly similar until 2008. The economic transition of the CEEs and the structural convergence process after EU accession may largely explain this trend. Graph 4.2.1 (Panel A) shows that the evolution of the Theil specialisation index for the EU as a whole is indeed driven by the evolution of the CEEs Theil specialisation index. The pace of convergence has, however, slowed in the EU and even inverted in the CEEs after 2008.([16])

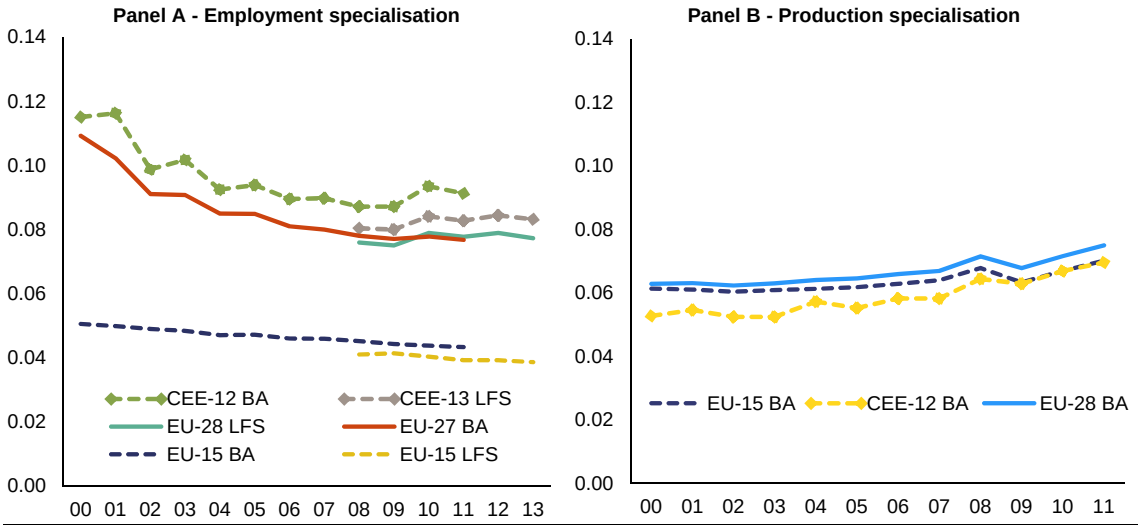
In contrast to the evolution in the CEEs, the crisis did not have a considerable effect on the overall degree of employment specialisation in the EU-15. In the EU-15, employment specialisation steadily declined over the observed period, however at a much slower rate than in the CEEs. This indicates slow convergence, also among regions in the EU-15. It is, however, surprising that asymmetric employment shocks in 2008 across the regions in the EU-15 do not seem to affect the converging trend. However, this overall trend is hiding different developments between regions.([17])

Particularly in various EU15 regions, employment specialisation became more similar to the EU average while it remained higher in peripheral and capital regions. Comparing Panels A and B of Graph 4.2.2 reveals that employment specialisation, particularly in the EU15, has eased with dark blue becoming more dominant. In turn, particularly regions in CEE regions and those including the capital remained highly specialised. This is in line with the observation that the trend came with employment in CEE becoming more similar with the EU15 has stopped in 2008.

([16]) Analysing business cycle synchronisation in EU15 and CEE Antonakakis and Tondl (2014) observe the same timing in the development of correlations in the cyclical components of real GDP.

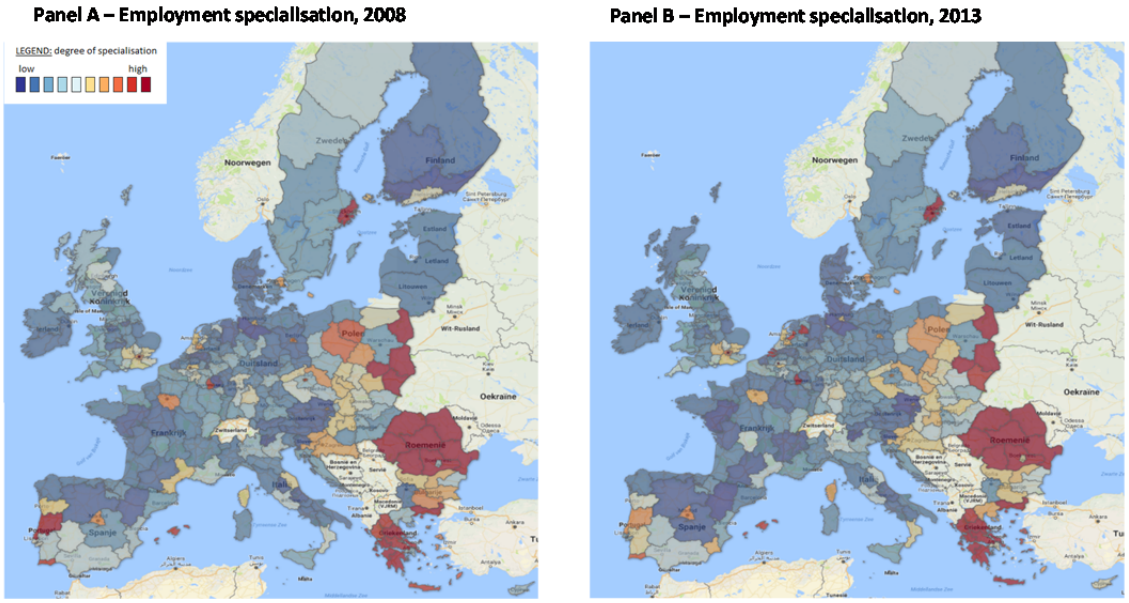
([17]) In about 119 regions, the specialisation indicator decreased between 2008 and 2013, while in 91 it increased.

Graph 4.2.1: **Theil index: Employment specialisation (left-hand panel), production specialisation (right-hand panel)**



Source: Own calculations based on Labour Force Survey (employment) and on Branch Accounts (production)

Graph 4.2.2: **Evolution of employment specialisation (Theil index)**

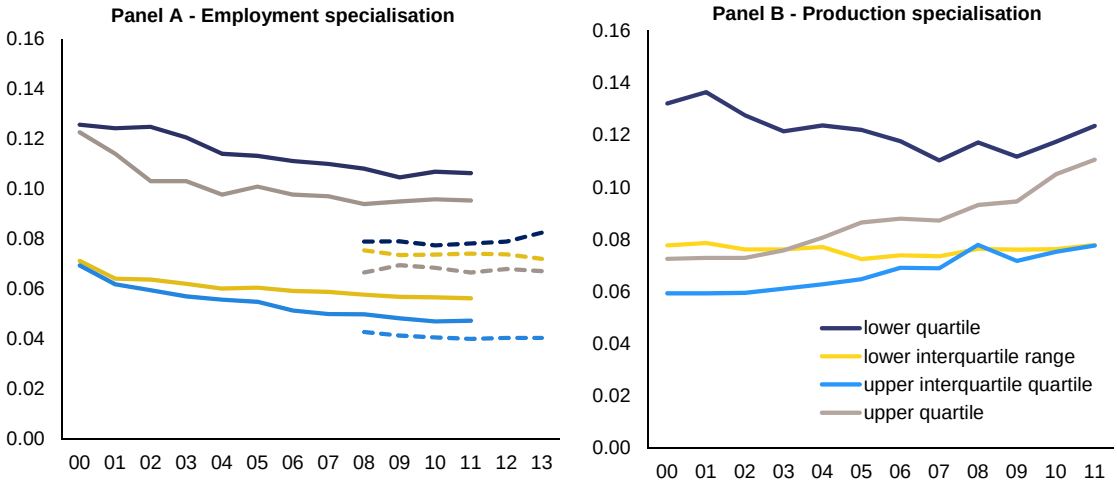


Source: Own calculations based on Labour Force Survey (employment)

Contrary to employment specialisation, production specialisation in the EU increased steadily with a temporary drop after 2008. This divergence might be due to labour market regulation, employment friendly policy measures and a more flexible adjustment of production processes. Graph 4.2.1 (Panel B) shows the evolution of production specialisation as measured by the Theil index. Production specialisation in EU-28 is slightly increasing. Also within the CEEs and the EU-15, production specialisation is rising, especially after 2004 when many CEE countries joined the EU.([18]) The crisis year 2008 caused only a temporary pause in this trend. Graph 4.2.2 confirms that the gradual increase in production specialisation between 2008 and 2011 was wide-spread in the EU.

Since 2008, regions with both relative good as well as unfavourable employment growth remained relatively specialised in terms of employment and their production specialisation even increased. As discussed in the previous section, there is a U-shaped relationship between regional employment growth since the crisis and specialisation: specialisation is higher for regions with both relatively high and relative low employment growth since 2008. Graph 4.2.3 shows that employment specialisation (see panel A) followed the similar decreasing trend as for the EU-28 as a whole at all quartiles, although the upper and lower quartile started at a higher level. The level of employment specialisation stabilised around 2008. On the other hand, the trend in production specialisation differs across quartiles, especially after 2008. Since then, production specialisation further increased in both the upper and lower quartile, while it remained relatively stable at the interquartile range (see panel B). Considering again the sectoral employment development, growth in the most important sectors picked-up very quickly in the successful regions, while low growth regions were still in an adjustment process (in 2011) with low or even negative growth rates.

Graph 4.2.3: **Evolution of specialisation (Theil index)**



Source: Own calculations based on Labour Force Survey (dotted lines) and Branch Accounts (solid lines)

([18]) Changes in regional production structures in the transition economies started already before the accession date. However, membership of the EU seems to accelerate the process due to a facilitated movement of factors.

Geographical concentration of sectors

As already argued in previous studies, the impact of the crisis on the regional structures might depend on the crisis sensitivity of the local sectors. We saw that regions with a high employment loss were more reliant on agriculture, construction, low-tech manufacturing and low-skill services than regions with positive net job creation. Similarly, looking from the sectoral perspective, in how far economic activity in specific sectors is concentrated in Europe has changed during the crisis. Analogously as in the previous section, we will present our results for the EU as a whole and for the EU-15 and CEEs separately. We also differentiate between developments in employment and gross value added and concentrate on the following broad sectors([19]):

- Agriculture (NACE A)
- Industry (NACE B-E)([20])
- Construction (NACE F)
- Trade, Accommodation & Food Services, as well as Transport (NACE G-J)
- Financial Services (NACE K-L)
- Business Services (NACE M-N)
- Public Services (NACE O-U)

The overall data indicate that agriculture, industry as well as financial and business services are rather concentrated while trade, accommodation & food services, transport and non-market services are the least concentrated sectors. More precisely, the following pattern can be observed (see Table 3):

1. The sectors agriculture, industry and financial and business services are relatively concentrated in the EU. Agriculture and industry are more concentrated within the EU-15 than within the CEEs, and vice versa for financial and business services. Generally, these sectors depend on the local setting – for agriculture this would imply the availability of land; for the industry as well as financial and business services this might be the presence of agglomeration externalities, including educated workforce, availability of component supplier, other firms in the same sector, specific infrastructure and institutions etc.

2. Construction activities are relatively dispersed in the EU, but less in the EU15 than the CEEs. This might be still due to the catching-up process of the CEEs.

3. Trade, accommodation & food services and transport as well as non-market services are the least concentrated sectors in the EU. This applies to both, the regional dispersion within the EU-15 and the CEEs. These sectors are either providing basic and non-tradable services (education, health and social services, tourism) or are rather independent from agglomeration externalities (trade and transport) due to decreasing transport costs.

([19]) Please find a detailed table A.2 in the Annex.
([20]) We refer to NACE C as manufacturing.

Table 4.2.1: **Concentration of sectors (Theil index)**

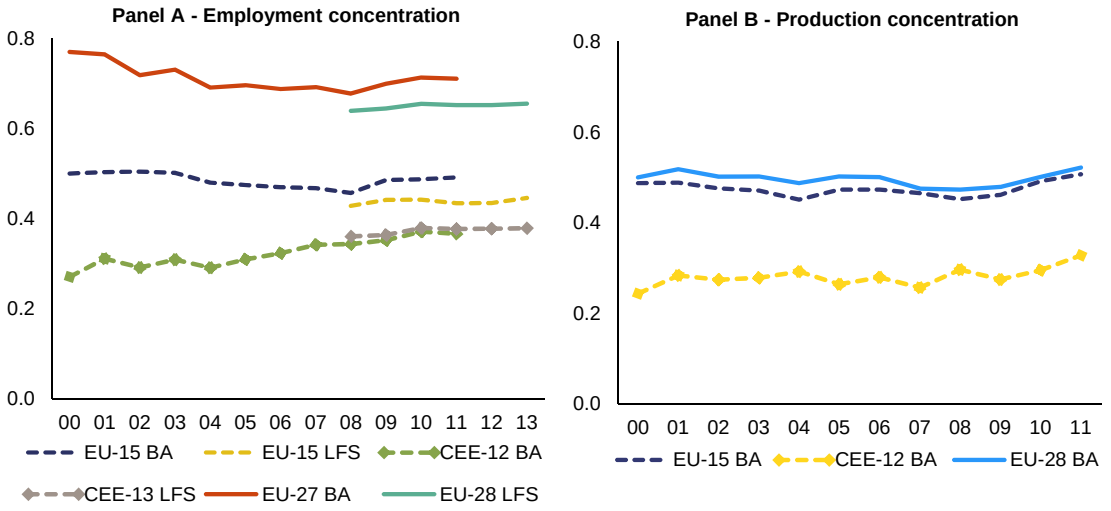
	employment (2013)			gross value added (2011)		
	EU-28	EU-15	CEE-13	EU-28	EU-15	CEE-13
Agriculture	0.66	0.45	0.38	0.52	0.51	0.33
Industry (1)	0.08	0.08	0.05	0.13	0.12	0.07
Construction	0.02	0.02	0.01	0.07	0.07	0.04
Trade, accommodation & food services and transport	0.01	0.01	0.02	0.02	0.02	0.02
Financial services	0.09	0.07	0.13	0.09	0.09	0.11
Business services	0.06	0.03	0.08	0.09	0.08	0.09
Non-market services	0.02	0.01	0.02	0.03	0.02	0.03

(1)Production concentration of industry is calculated for manufacturing only, while it includes mining (NACE B), energy (NACE D) and water (NACE E) for employment concentration.
Source: Own calculations based on Labour Force Survey (employment) and Branch Accounts (gross value added)

Agriculture

The relatively high regional concentration of the agricultural sector remained relatively stable up to 2008 and then increased slightly. The employment concentration in agriculture followed this trend after a decline in the early 2000s (see panel A of Graph 4.2.4). The increased concentration of agricultural production (in terms of GVA) since 2008 is even more pronounced (see panel B). Also within both the EU-15 and CEEs, production concentration in agriculture has increased since the beginning of the crisis.

Graph 4.2.4: **Concentration in the agricultural sector (Theil index)**



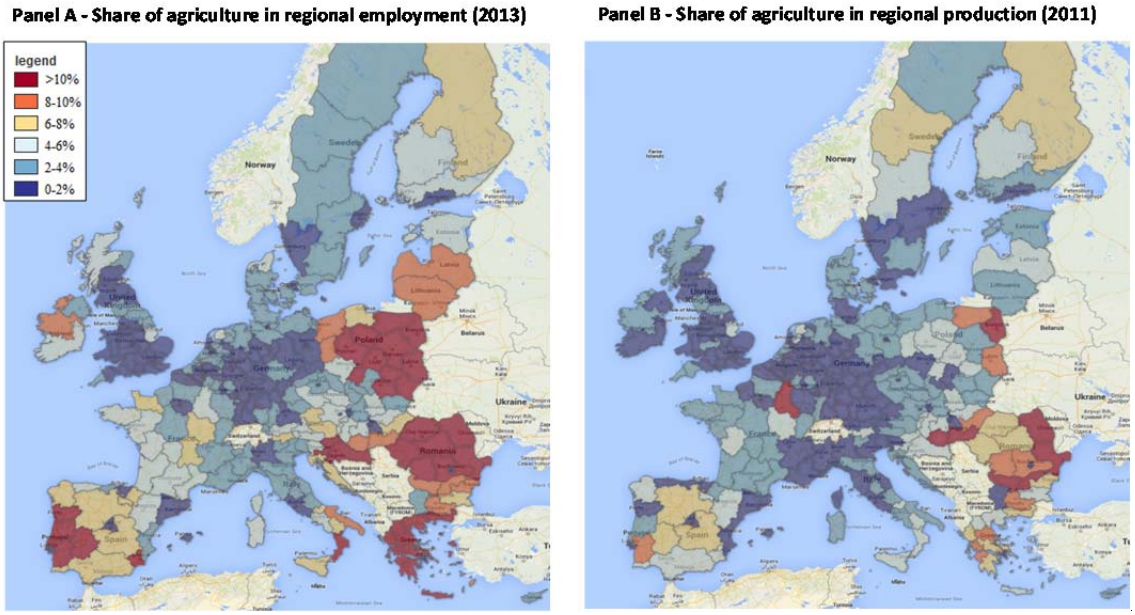
Source: Own calculations based on Labour Force Survey (LFS) and Branch Accounts (BA)

Most regions that suffered from the crisis in terms of job losses were relatively dependent on agriculture. Graph 4.2.5 shows the share of agriculture in total regional employment (panel A) and in total regional gross value added (panel B). Employment in agriculture is relatively important in regions in Poland, Romania, Greece, South Italy and Portugal. In these regions, the average share of total employment in agriculture in 2013 was more than three times as high as the EU average of 4.9%. But

similar to EU28, employment growth in agriculture is continuously decreasing([21]). Gross value added of the agricultural sector is relatively important in the same regions where its employment share is relatively high. In addition, agriculture is also important in some regions of Finland and Sweden (forestry), Spain and France (Champagne region) depending on the availability of specific resources. Regions with high concentration in agriculture are often the ones having experienced large reductions in both total employment and total gross value added, with Poland being an exception. This can be seen by comparing the graph below with Graph 4.1.1.

In regions most affected by the crisis, employment in other sectors fell more than in agriculture thus increasing the relative reliance on agriculture. Using the groups presented in Table 2 above, in regions most affected by the crisis, the employment in agriculture has been decreasing over a longer period as shown in panel B of Graph 4.2.6. However, as total regional employment decreased even faster, the declining trend in the regional employment share in agriculture stabilised (see panel A of Graph 4.2.6). The opposite scenario occurred in better performing regions. There, the regional employment share continued to fall. This explains the recent increase in concentration of the agricultural sector. However, one has to keep in mind that the agricultural sector in these regions is very small in terms of GVA and employment.

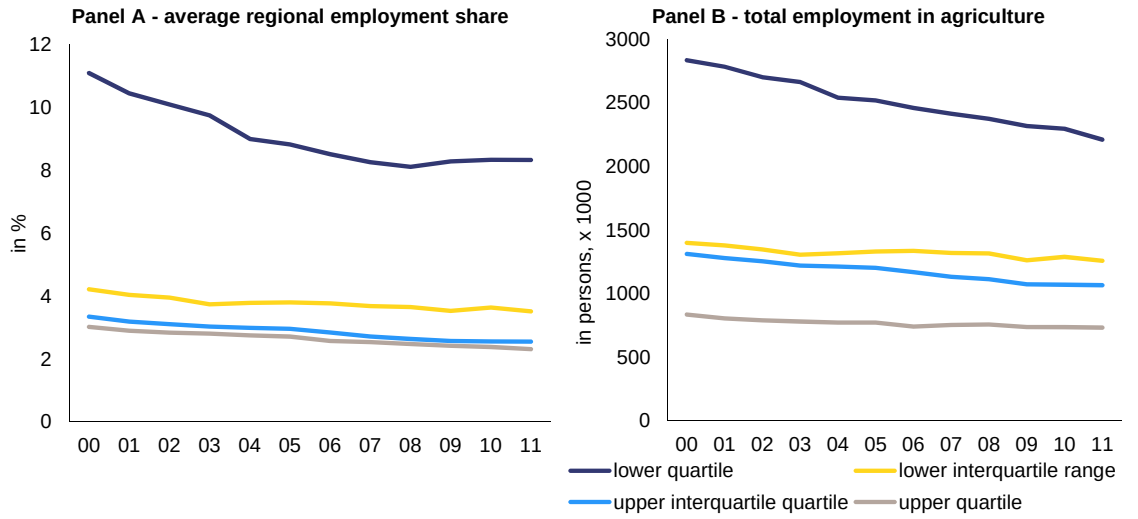
Graph 4.2.5: **Share of employment and production in agriculture**



Source: Own calculations based on Labour Force Survey (panel A) and Branch Accounts (panel B)

([21]) See also Stehrer and Ward (2012).

Graph 4.2.6: **Employment in agriculture**

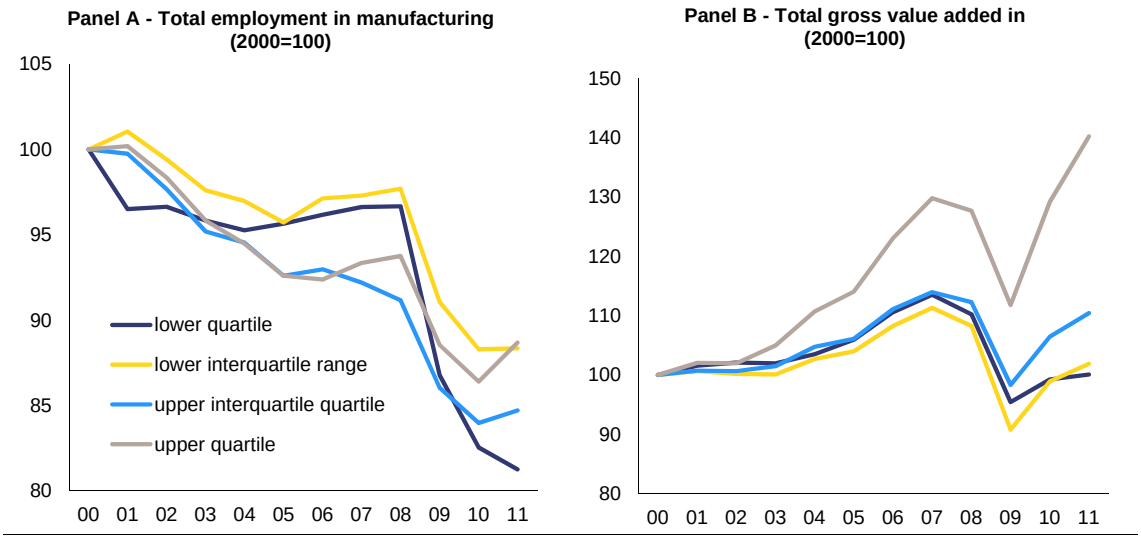


Source: Own calculations based on Branch Accounts

Industrial sector

The industrial sector and especially the manufacturing sector were particularly affected by the economic crisis. The loss of employment and production in manufacturing was large in many regions. The development in total manufacturing per performance quartile is shown in Graph 4.2.7 for total employment (panel A) and gross value added (panel B). The sector has experienced similar developments during former crises. Regions within the upper quartile, i.e. the top 25% of regions with highest job creation between 2008 and 2013, initially saw a large drop in their manufacturing employment and production. The loss in gross value added in the manufacturing was pertinent across all regions, although German regional production was most affected. Since 2010, however, manufacturing employment and especially production is again increasing in the better performing regions, though the recovery in employment lagged behind, due to different labour market settings and country specific crisis policy measures like the possibility of reducing working hours to avoid unemployment during the crisis in Germany. As also shown in Graph 4.2.7, the difference between lower and upper quartile regions is remarkable and can also be observed on country level (Graph 4.2.9). Considering the sub-sectors of manufacturing, the investment good sector with motor, machinery and investment equipment experienced initially considerable employment and production losses (Stehrer et al. 2012a). This might be due to the fact that the purchase of investment goods is most sensitive to the business cycles as they can be easier postponed. The same argument would hold for durable consumer goods (e.g. cars), which are not instantly needed. De Groot et al. (2011) confirm this observation in their analysis on the crisis sensitivity of sectors. Manufacturing, especially transport equipment, electronics and other manufacturing are the sectors which react most to business cycle movements. The drop in demand has been even reinforced by the marked drop in international trade with partner regions within the EU but also worldwide.

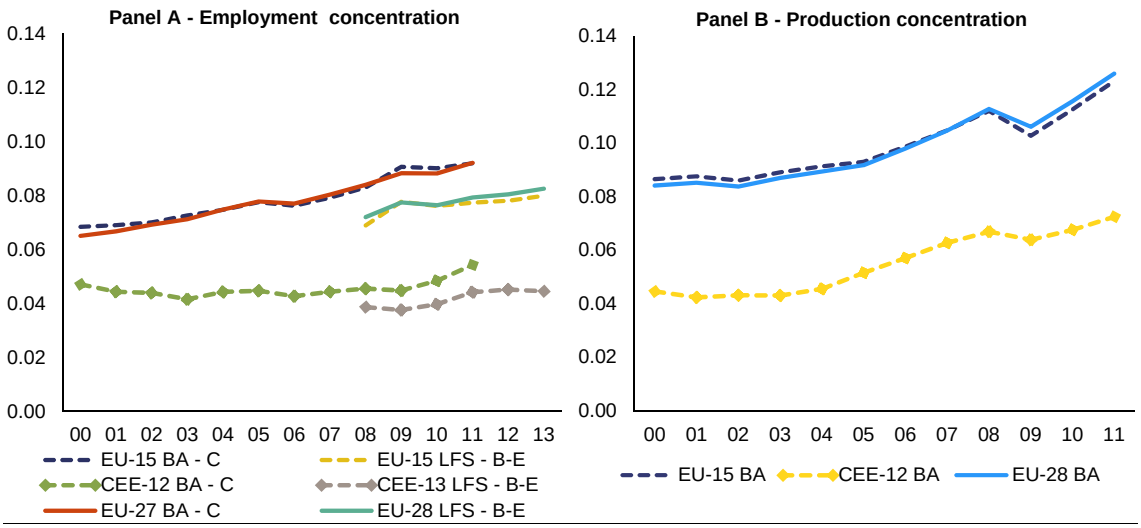
Graph 4.2.7: **Developments in manufacturing across performance groups**



Source: Own calculations based on Branch Accounts

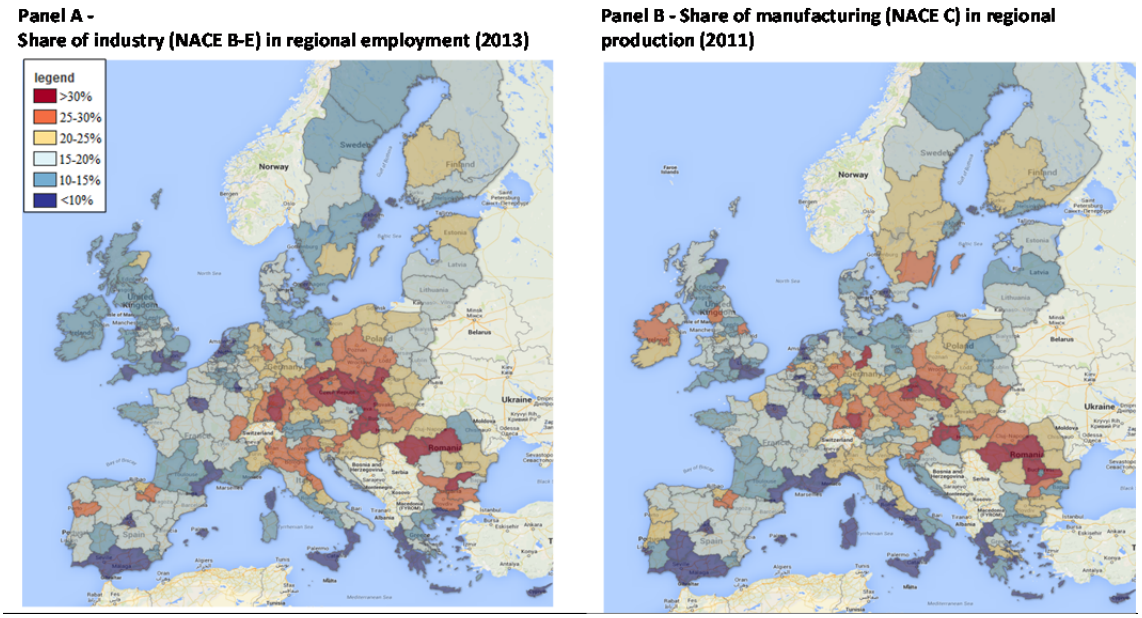
The outbreak of the crisis only had a temporary influence on the increasingly concentrating industrial sector in the EU (Graph 4.2.8)**.** The temporary dip is mostly visible in the developments of production concentration. Both employment and production concentration within the EU-15 run parallel with the development in the EU-28. This is due to the fact that about 70% of employment and 90% of production in manufacturing (the biggest branch within the industrial sector) is taking place within EU15. Production concentration in the CEEs follows a similar upward trend since 2004 as in the EU-28. This contrasts to the development in employment concentration in the CEE regions which remained stable at a relatively low level until 2008. This may indicate differences in productivity developments in the CEEs in the pre-crisis period. This increasing concentration trend has been similarly observed by other studies (e.g. Vechiu and Makhlouf, 2014, Bickenbach et al., 2010).

Graph 4.2.8: **Concentration in the industrial sector (Theil index)**



Source: Own calculations based on Labour Force Survey (LFS) and Branch Accounts (BA) (note: B-E and C refers to NACE coding)

Graph 4.2.9: **Share of employment and production in manufacturing**



Source: Own calculations based on Labour Force Survey (panel A) and Branch Accounts (panel B)

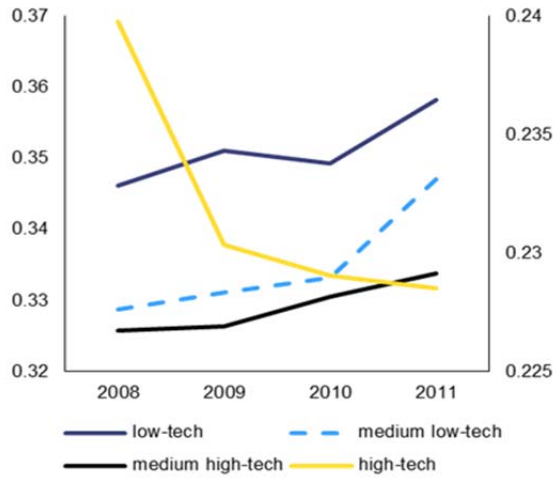
While productivity of the manufacturing sector across regions in the EU is steadily increasing, regions with a large industrial base are outperforming other regions. Total employment diminished constantly in industry, especially after 2008. However, this development occurred less quickly in regions with a relative large initial industrial employment share.([22]) In contrast to employment, productivity increased significantly as GVA considerably increased since 2000. The increase was even more prominent in regions with relative high initial share of industry in total regional production.([23]) Here the effect of agglomeration and urbanisation externalities might play a role, with industrial regions attracting related industries (Frenken et al., 2007, Eriksson and Hane-Weijman, 2015).

Since 2008, manufacturing became more concentrated in selected regions in both the CEE and the EU15. This applies in CEE especially for the Czech Republic, Hungary, Poland and Slovakia and in the EU-15 especially for Austria, Germany and the Netherlands. Although most of employment and production in manufacturing and industry is located in the EU-15, the importance of manufacturing for local economies in CEE regions cannot be overstated. Since the accession to the EU, low factor costs in CEE attracted manufacturing industries. As a result, the average manufacturing share in regional gross value added increased from 19.5% in 2000 to 25.5% in 2011. The regional employment share remained fairly constant around 20% in CEE regions, while it decreased from 17% to 13% in the EU-15 as shown in Graph 4.2.9 for the year 2013 (share of industrial employment) and 2011 (production share in manufacturing). This development reflects strong productivity gains. However, not all regions in CEE attracted manufacturing industries to the same extent as shown by the same graph. Also within the EU-15, there are large differences in the importance of industry across regions. A higher initial specialisation of the region in industry as measured by the location coefficient (>1) seems to favour increasing specialisation. This might be due to positive agglomeration externalities as well as backward and forward linkages. Brakman et al. (2015a) or Martin et al. (2013) showed in their resilience analysis that regions with a larger industrial base and located in urban areas adjusted more easily after the downturn.

([22]) The change in the regional employment share of manufacturing between 2000 and 2011 is significantly positively related with its initial value in 2000 (t-value = 2.3).

([23]) The change in the regional production share of manufacturing between 2000 and 2011 is significantly positively related with its initial value in 2000 (t-value = 13.0).

Graph 4.2.10: **Concentration in the manufacturing sector by technology level (Theil index)**



Source: Own calculations based on Structural Business Statistics

Considering structural developments in the manufacturing sector according to the technology level, we observe the following:

- Low-tech manufacturing is the most concentrated among the manufacturing sector, followed by the medium-low tech and the medium- high tech.

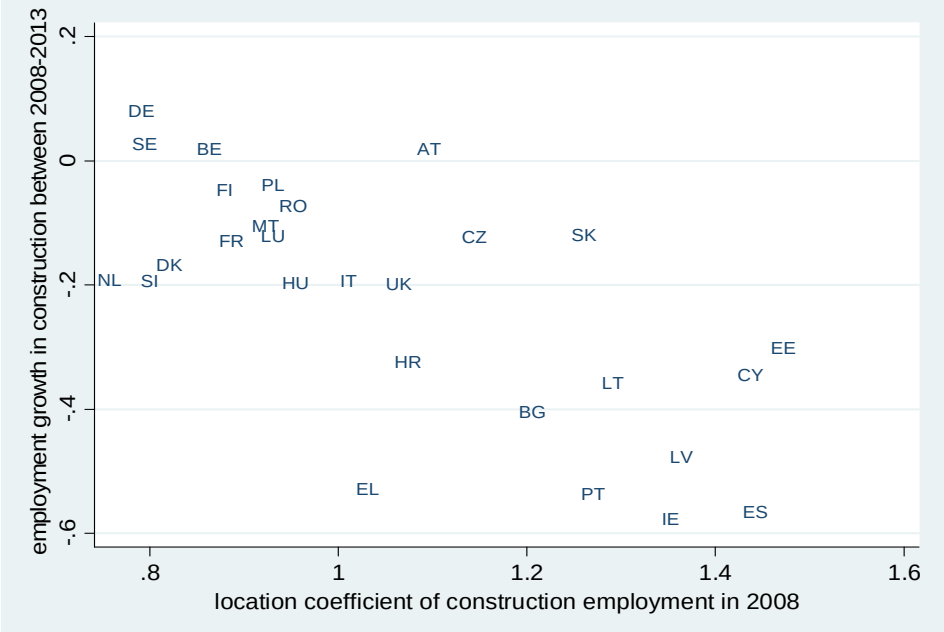
- These three sectors are increasingly concentrating, but follow a different time path.

- In turn, the high-tech sector is shows a dispersing trend during the crisis years and is now the least concentrated among these sectors.

Construction

After a strong rise of construction activities since the early 2000s, employment and gross value added in construction suddenly caved in with the outbreak of the crisis in 2008. The loss of employment and production in construction was highest in the regions with a relatively large construction sector. As described before, one of the roots of the crisis were mortgage credits and the banking sector combined with an overshooting in housing markets. As the demand for houses/apartments dropped suddenly, the construction sector suffered from a large fall in employment. This is shown in Graph 4.2.11 at the country level where the initial location coefficient in construction employment is clearly negatively associated with employment growth in construction between 2008 and 2013. A location coefficient higher than one indicates that the regional employment share was above the EU average of 8.4% in 2008. Also in earlier recessions, the construction sector has been affected by large drops in employment (Stehrer et al., 2012b). During the recession analysed here, this effect might have been intensified since the financial crisis had its roots in housing bubbles in different countries. However, in French, Belgian and German regions, employment in construction has not been affected negatively. Stehrer et al. (2012b) are explaining this with relatively stable house price developments in e.g. Germany and the absence of a bubble.

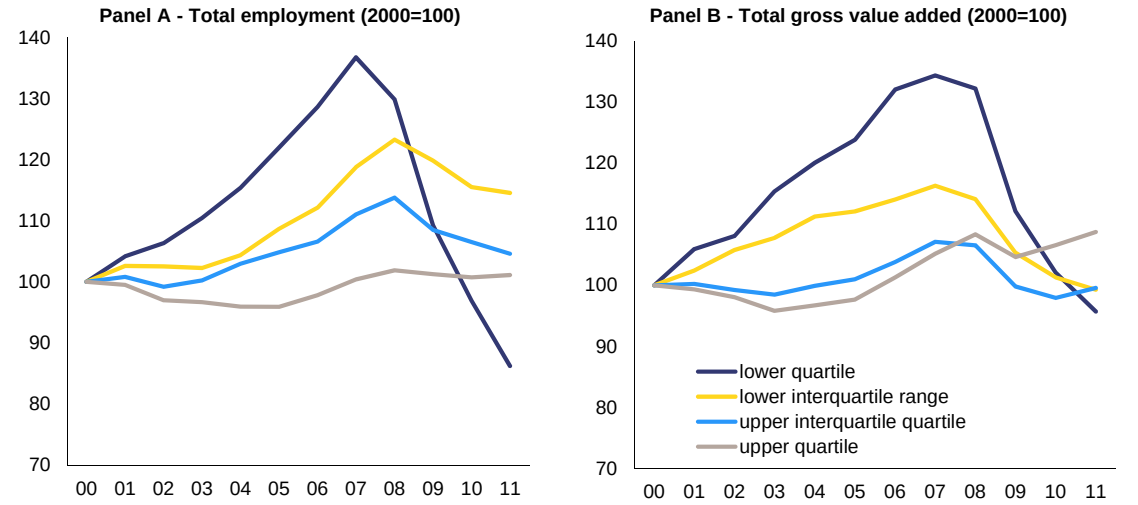
Graph 4.2.11: **Initial construction concentration and loss in construction employment afterwards**



Source: Own calculations based on Labour Force Survey

Most regions facing a strong fall of construction employment also saw a large decrease in total employment. The regions belonging to the quartile with the highest loss of total employment in the period 2008-2013 were building up a high concentration level in this sector before the crisis also induced by misallocation of resources and experienced then the largest drop in construction employment, without recent signs of improvement. This is shown in Graph 4.2.12 panel A. Gross value added in construction shows parallel developments as employment, which could be partly interpreted as correcting inefficiencies in the housing market that have been building up before the crisis years (see panel B of Graph 4.2.12). The same graph also shows that the quartile with the highest loss of total employment in the period 2008-2013 experienced also the largest rise in employment in the construction sector in the years before the outbreak of the crisis.

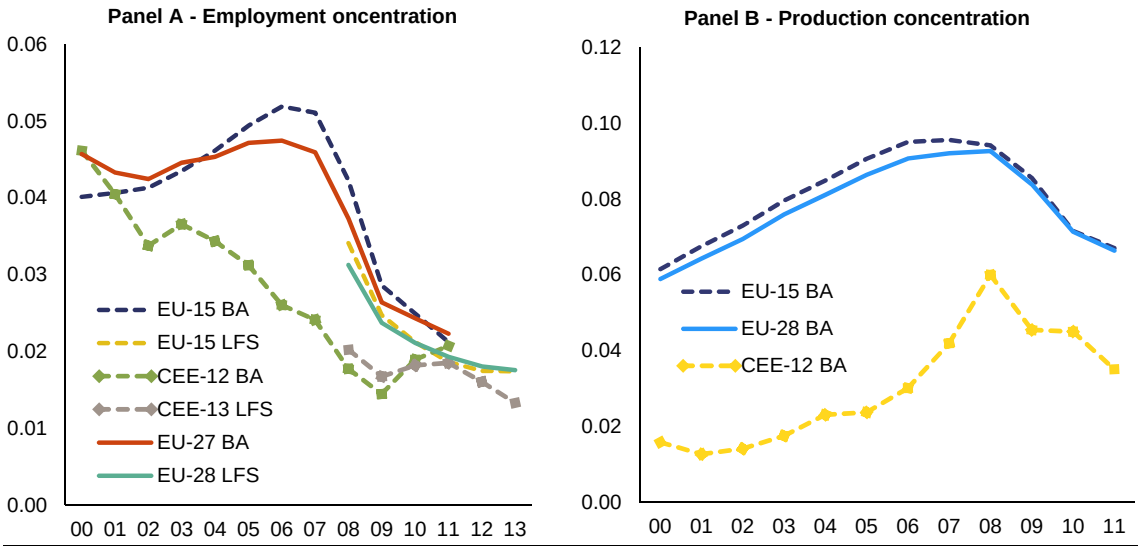
Graph 4.2.12: **Development in construction across performance groups**



Source: Own calculations based on Branch Accounts

The regional concentration of the construction sector in the EU declined sharply after the construction boom reached its peak in 2007. During the period 2000-2013, the developments of concentration in construction differed markedly between EU-15 and CEE. In the EU-15 both the Theil employment and production concentration indices gradually increased until 2007, before falling during the crisis. In turn, within the CEE before the crisis the Theil concentration index declined steadily when measures based on employment data while it increased sharply in terms of gross value added. One explanation may be that the accession to the EU facilitated access to finance which made the realisation of large infrastructure projects possible as mentioned by Stierle-von Schütz and Stierle (2013).

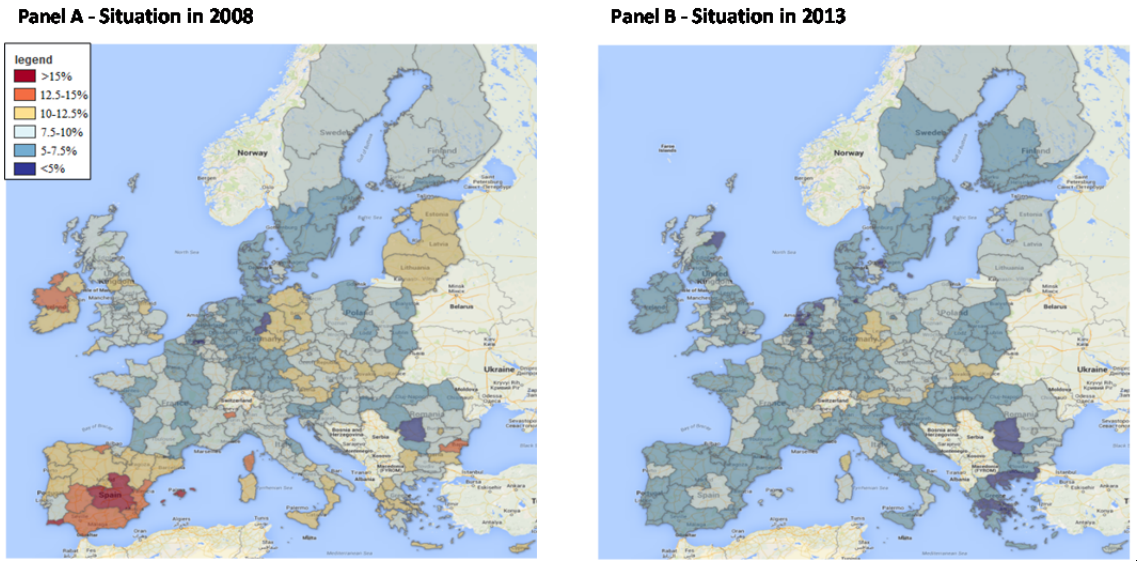
Graph 4.2.13: **Concentration in construction (Theil index)**



Source: Own calculations based on Labour Force Survey (LFS) and Branch Accounts (BA)

As regional employment share in construction equalised across regions during the crisis, concentration in the construction sector dropped significantly. The decrease in employment concentration in the construction sector is mainly due to the drop in employment shares in Ireland, Portugal, Spain and Greece. This becomes visible comparing panel A and B of Graph 4.2.14. A relatively high share of the labour force in Ireland, Portugal, Spain and Greece were employed in the construction sector in 2008. Until 2013 the economic crisis caused a dramatic fall in employment in construction in these countries as can be seen in the graph on the right hand side. Also the gross value added produced by the construction sector decreased sharply in Ireland and Greece in the period 2008-2011 (not shown here). However, construction remained rather concentrated in terms of gross value added in Spanish and Portuguese regions until 2011.

Graph 4.2.14: **Share of construction in total regional employment**

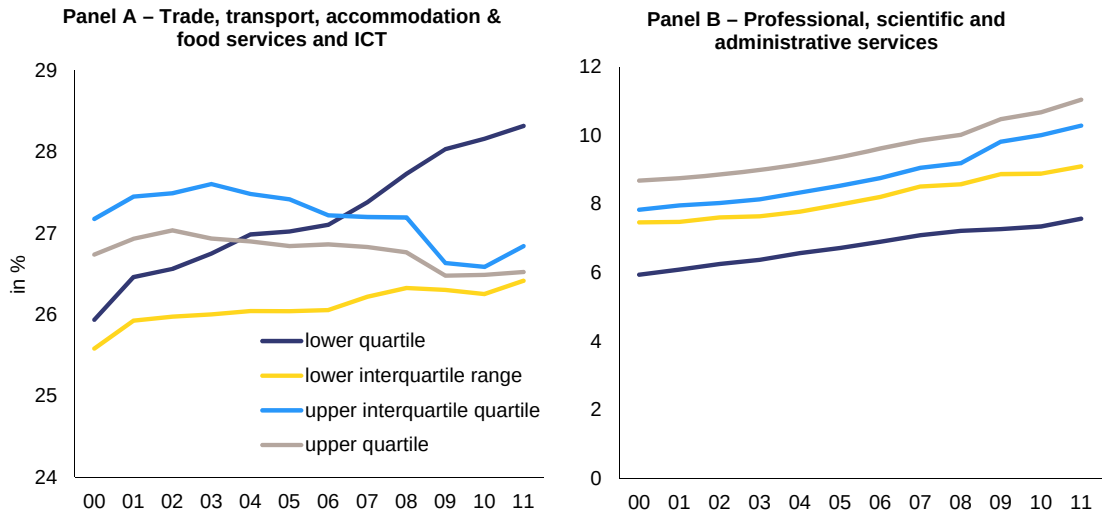


Source: Own calculations based on Labour Force Survey (LFS) and Branch Accounts (BA)

Market services

The impact of the economic crisis on market services was limited compared with the one on construction and industry. In particular in regions where the loss in employment was high, the employment share of business services in the regional economy has increased (see Graph 4.2.20). Within low-performing regions, employment in this sector, however, decreased by -2.1% on average between 2008-2013. In regions where total employment growth after the crisis was higher, also job creation in business services was more favourable. For example, the upper quartile saw an increase of 1.8% in employment in business services in the same period. In particular, employment developments in professional, scientific and administrative services were favourable in these regions as average regional growth between 2008-2013 reached 3.7% y-o-y.

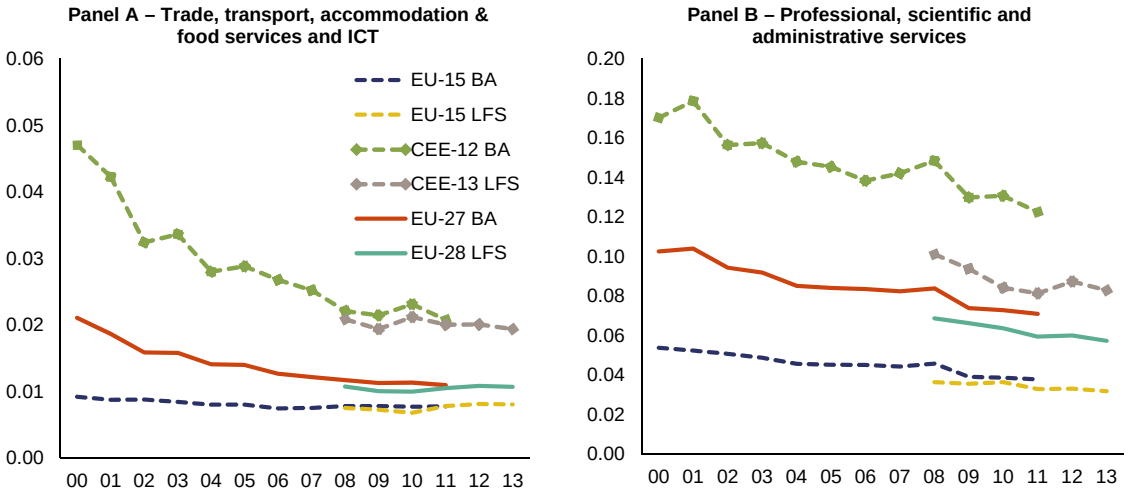
Graph 4.2.15: **Average share of market services in total regional employment across performance groups**



Source: Own calculations based on Branch Accounts

Changes in concentration of market services were limited after 2008. Employment and production concentration in market services is relatively low compared to other sectors. The sector might be more independent from agglomeration externalities and the availability of specialised input factors as e.g. labour force or natural resources. Therefore, it might be rather located where costs are low. Furthermore, the importance of business services is more similar across EU-15 regions than for regions in the CEEs and more so for trade, accommodation & food services and transport than for other market services like professional, technical and administrative services. Graph 4.2.16 shows that the employment concentration of business services within the CEEs and also within the EU-28 has declined in the period 2000-2013. This may be the result of structural change of CEEs with the development of new business activities outside of urban centres.

Graph 4.2.16: **Employment concentration in business services (Theil index)**



Source: Own calculations based on Labour Force Survey (LFS) and Branch Accounts (BA)

Hotels, restaurants and catering (accommodation & food services) remain sectors of relative high importance for regions in Southern Europe although overall these sectors are rather dispersed in

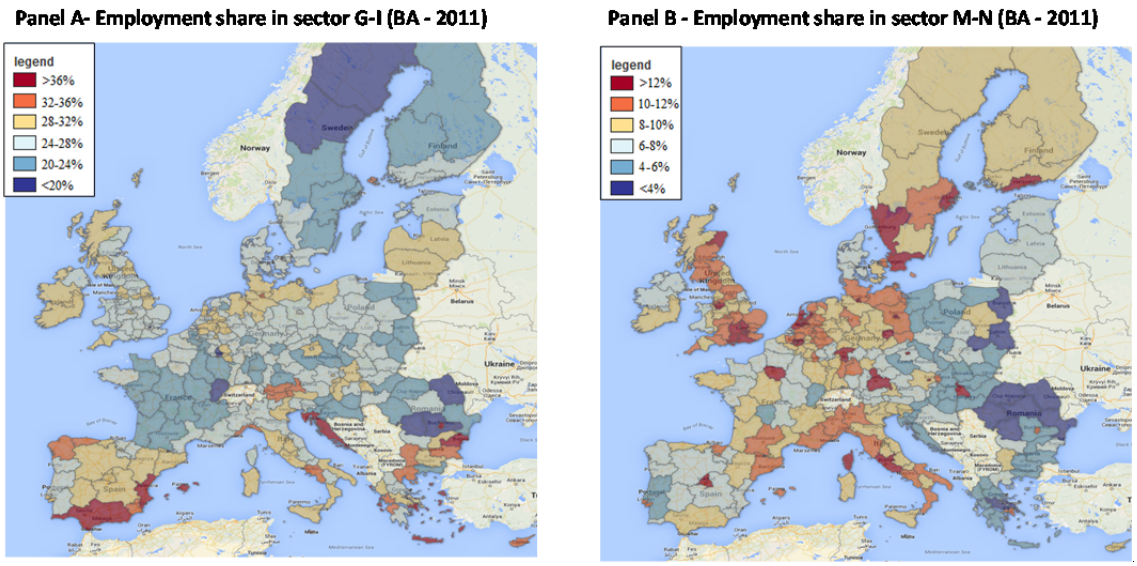
the EU28. As a result of the geographical location of most of these touristic regions, accommodation as well as food and beverage services largely contribute to the local economy (see panel A of Graph 4.2.17). Thus, the employment share of the sector is also relatively important in these regions. More than 15% of the local workforce was employed in accommodation & food services in many of the Greek islands in the Aegean Sea, the Algarve region in Portugal and the Spanish Canary Islands in 2011. Also in some regions of Italy, Bulgaria, Croatia, and in the French and Austrian Alps, the share of accommodation & food services in regional employment is much higher than the EU average. As the sector was less exposed to the crisis than other sectors, its share in employment also increased in most regions between 2008-2011, especially in the lower quartile regions([24]). Some people experiencing job loss in construction or manufacturing might have opened their own business or found a job in the tourism sector.

Concentration of accommodation & food services, transport services and trade supporting activities has hardly been affected by the crisis. Accommodation & food services as well as transport services are rather concentrated; while trade supporting activities remain much more disperse. The geographical location of regions determines also to a large extent the presence of transport services. Transport services tend to be concentrated in regions with important sea ports and airports or close to important road networks, which give access to the hinterland. In contrast to accommodation & food services, and transport services, trade supporting services are much more widely present. These characteristics have hardly changed in the course of the economic crisis.

Professional, technical and administrative support services remain predominantly located in some EU-15 regions, while in the CEEs these activities are deconcentrating. These services are important for some regions in the EU-15, roughly generating 95% of total EU gross value added in these service activities. In particular, these services are highly concentrated in large cities in the EU-15, like London, Paris, Rome and Madrid, where they employ more than 10% of the local workforce (see panel B of Graph 4.2.17). While concentration in the subsector scientific research and development decreased between 2008-2011, security and investigation activities were increasingly concentrated according to SBS data. Also these service sectors recovered relatively quickly from the economic crisis of 2008 with the total employment in 2011 3 % above the level of 2008. In the CEEs, there is an overall tendency of dispersion across nearly all subsectors.

([24]) It slightly decreased in the upper quartile regions.

Graph 4.2.17: **Employment shares in market service sectors**



Source: Own calculations based on Branch Accounts (BA).

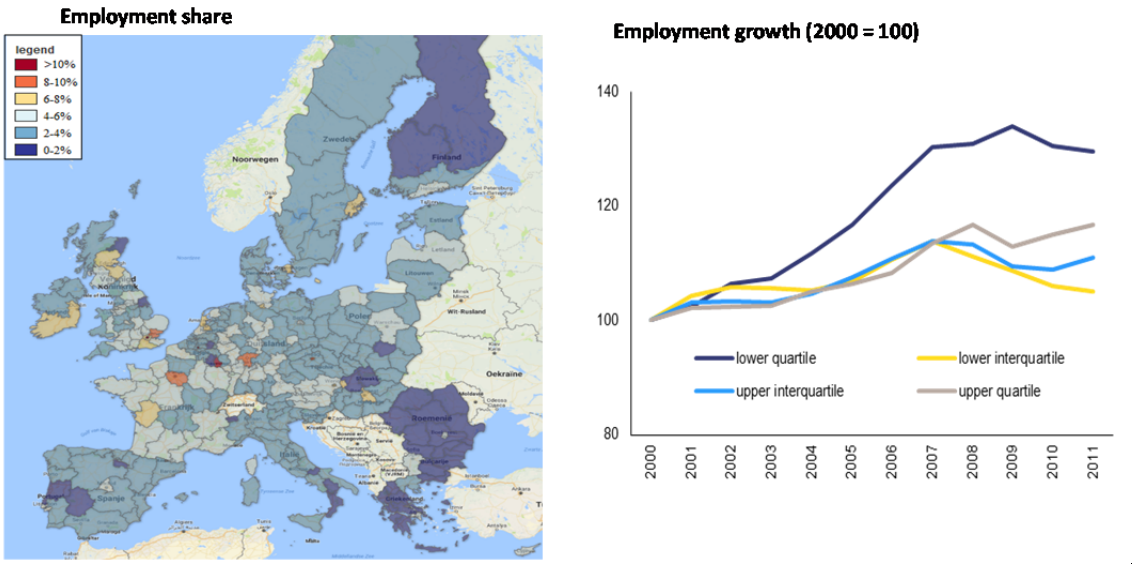
Financial services([25])

Financial services in the EU are strongly concentrated in financial centres like London, Luxembourg, Brussels, Frankfurt am Main, Paris, etc. Banking and related services in these financial centres employ 10% of total regional employment. In turn, in some regions in Romania, Bulgaria and Greece the employment share of the financial service sector is less than 1% of total regional employment. Graph 4.2.18 depicts the geographical employment share in financial services.

Post 2008, both employment and production concentration increased in the CEECs strongly, while in the EU-15 only production concentration shows an upward tick (see Graph 4.2.19**).** The forced deleveraging of banks in the aftermath of the crisis sharply reduced cross-border lending. Western European banks concentrated on core markets in Eastern Europe such as Poland, the Czech Republic and Slovakia. With access to foreign credit becoming more difficult elsewhere, this might explain the increasing concentration in the CEECs since 2008 (see FT, 2011). At the same time, financial services might have focused their activities to bigger cities in order to reduce costs. As Western banks focused on their domestic markets, partially reversing their strong expansion towards Eastern Europe, this also might explain why concentration patterns did not alter strongly in the EU-15. The increasing trend in production concentration in the financial sector must be interpreted with care, as the national accounts imperfectly measure the value-added of financial intermediation services (Haldane et al., 2010).

([25]) The analysis of concentration pattern for the financial sector is especially challenging since consistent employment data is not available for all countries included in the analysis. We combined available data sources such as the Branch Accounts, the Labour Force Survey and data used in Stierle-von Schütz and Stierle (2013). We are aware that interpretation should be done carefully. Additionally, the measurement of gross valued added of the financial sector is based on indirectly measuring Financial Intermediation Services that also assess the value of financial services embedded in interest rate margins. Various scenarios might bias this measurement approach, such as changes in risk taking due to increased leveraging, larger trading books, etc., particularly in the crisis context (see also Haldane et al., 2010).

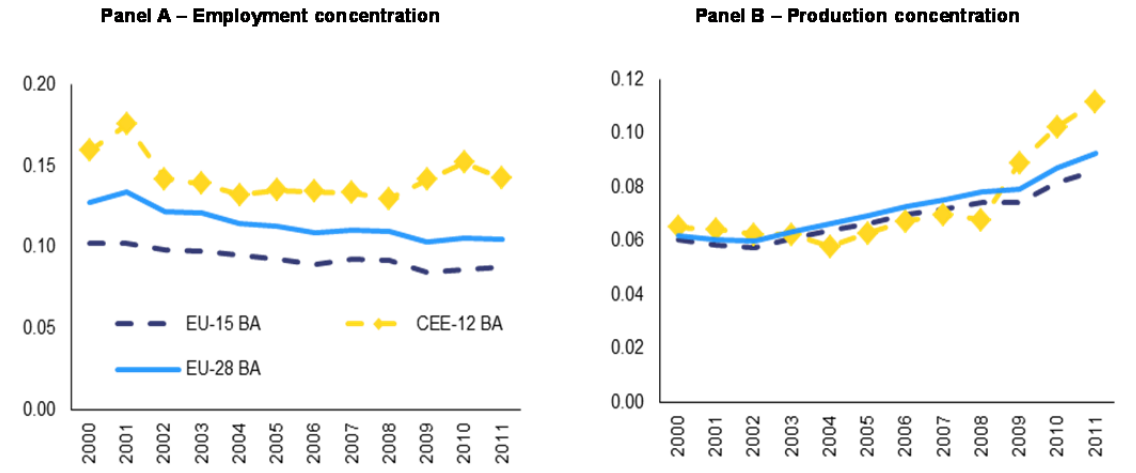
Graph 4.2.18: **Employment in financial services (2011)**



Source: Own calculations based on Branch Accounts (BA).

Notwithstanding the strong sector concentration, employment in financial services expanded rapidly in low performing regions in the run up to the crisis. The quartile of regions undergoing the largest drop in employment between 2008-2013, largely outperformed other regions in terms of employment growth in financial services in the period 2000-2008, with an average cumulative growth of 34%. In the other regions, average cumulative employment growth in this period was much more modest at around 15%. This is depicted in Graph 4.2.19.

Graph 4.2.19: **Concentration in the Financial services sector (Theil index)**



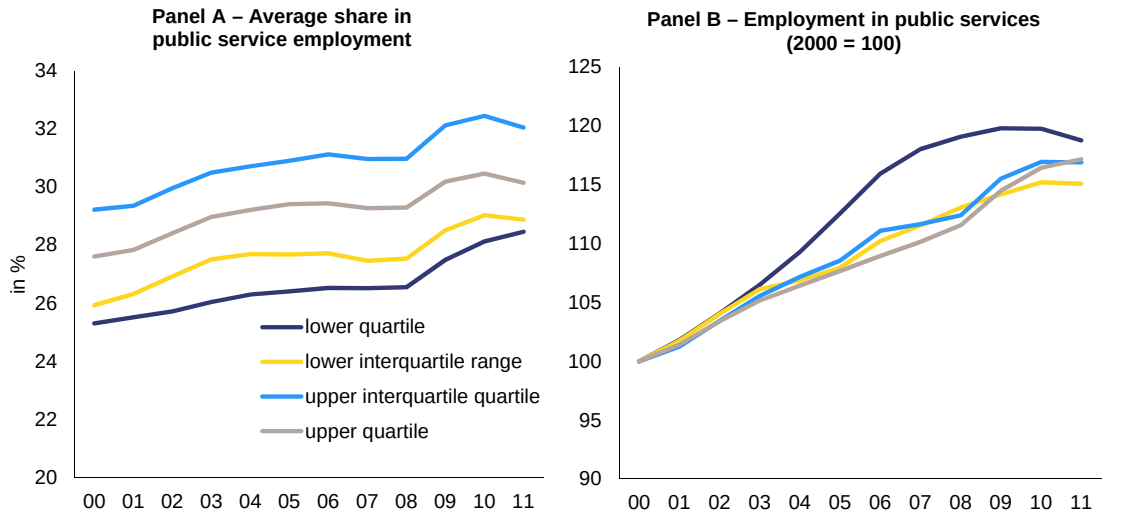
Source: Own calculations based on Labour Force Survey (LFS) and Branch Accounts (BA)

Non-market services([26])

After the period 2000-2011 when employment in non-market services increased, its growth curbed in the post-crisis and even decreased in regions with high loss of private sector employment. Panel A of Graph 4.2.20 shows that the share of non-market services in total employment increased around the outbreak of the crisis due to job losses in other sectors. Additionally, total employment increased in this sector in most regions. This occurred after a slow upward trend between 2000 and 2008. Employment in the non-market service sector only started to decrease around 2010 with a lag compared to employment loss in the private sector (see Panel B of Graph 4.2.20).

The share of non-market services in total regional employment increased, even though employment in these services stopped growing after 2008 due to shifts within the regional structure. Initially, the non-market service sector was shielded against the impact of the crisis. However, public services had to cut employment under the pressure of rapidly deteriorating public finances. This pressure was larger in regions where the total employment loss was high (mainly in the lower quartile regions). Nevertheless, the share of non-market services in total employment in these regions increased as the loss of private sector employment was even stronger. In the other regions, the share of non-market services in regional employment started to decrease in 2011, when job creation in the private sector recovered.

Graph 4.2.20: **Average share of non-market services in total regional employment across performance groups**

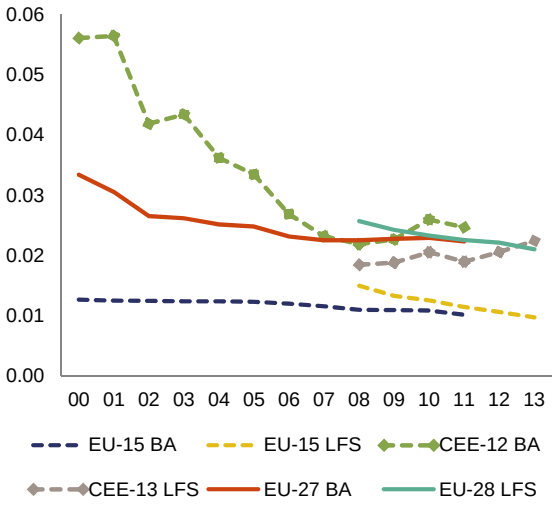


Source: Own calculations based on Branch Accounts

Employment concentration of non-market services has slightly decreased since 2008 in the EU, while marginally increasing in the CEE, but the sector remains relatively and absolutely dispersed when compared with other sectors. Graph 4.2.21 shows that in the pre-crisis period, employment concentration in non-market services has decreased in the CEE and to a lesser extent also in the EU-28. Since 2008, employment concentration in non-market services in the EU-28 remained relatively stable and increased again in the CEEs.

([26]) Non-market services are broadly defined and also contain the provision of health care, education and cultural services (sector O-U). Since price developments in these sectors are difficult to measure and are frequently approximated by costs rather than market prices, it is less straightforward to interpret gross value added developments. Therefore, we only provide graphs based on employment in this section.

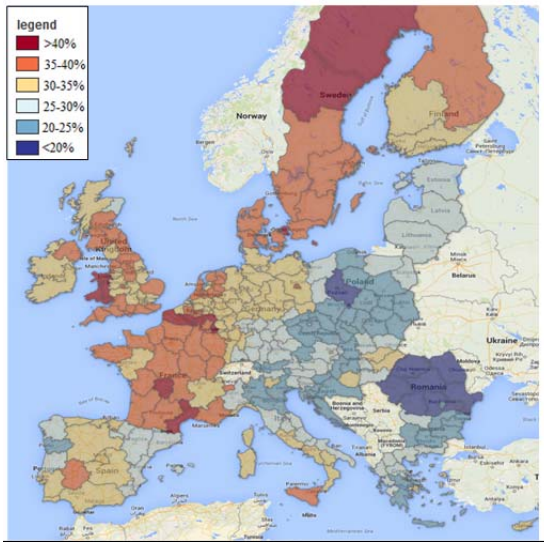
Graph 4.2.21: **Employment concentration of non-market services (Theil index)**



Source: Own calculations based on Labour Force Survey (LFS) and Branch Accounts (BA)

As a general trend, the convergence of the economies in CEE towards the EU-15 reduced the concentration of non-market services in the EU as a whole, but in some, especially structurally weak regions these services remain principal employers in EU-15 (see Graph 4.2.22). In many regions in the EU-15, non-market services employ more than 30% of the regional workforce. The share of non-market services in regional employment in the CEEs is on average 10 pps. below the level in the EU-15.

Graph 4.2.22: **Employment in public services (LFS - 2013)**



Source: Own calculations based on Labour Force Survey

5. CONCLUSION

European regions were adversely affected by the 2008/2009 economic crisis. The impact on regional employment and production patterns, however, varied significantly both between and within national borders. Similarly, the impact on sectors also varied. While employment fell significantly and recovered slowly in some sectors, such as construction and industry, most service sectors suffered little, if at all.

This paper examined how economic structures changed across regions and sectors during the years of the financial crisis. Our analysis shows that, the initial sectoral structures of regions differed markedly between regions with unfavourable employment growth and regions being able to increase employment since 2008. Low-growth regions were found to be more reliant on agriculture, low-tech manufacturing, construction and certain services like trade, accommodation and food services, and transport, which are less skill-intensive than other business services. By contrast, regions that tended to specialise in medium and high-tech manufacturing, or skill-intensive services like professional, technical and administrative support services, saw better employment developments.

Notwithstanding large differences in the economic structures of European regions before the crisis, the impact of the crisis on overall regional specialisation has been limited. Before 2008, sectoral employment composition had been homogenising within the EU. This convergence process across EU regions is largely explained by the economic transition of regions in Central and Eastern Europe. In the post-crisis period, however, this pace of convergence has slowed. Whereas employment specialisation had been decreasing, production specialisation has been increasing since the 2000s. Measured in terms of gross value added, both regions with relatively good as well as regions with rather unfavourable employment growth, have become more dependent on specific economic activities since 2008.

There have been significant changes in the regional concentration of certain economic activities. The construction sector stands out in our analysis. When interpreting the indicator results, the cyclical dependency of the sector has to be taken into account. Moreover, the boom of the sector in the early 2000s was partly driven by a mix of market and policy measures which favoured a possible misallocation of resources. The regional concentration of the construction sector in the EU declined sharply after the construction boom reached its peak in 2007. In turn, since 2008, the industry sector has become more concentrated in selected regions in both Central and Eastern Europe (CEE) and the EU15. The impact of the economic crisis on market services was limited in comparison to the impact on construction and industry. This may explain why the changes in concentration of market services were contained after 2008. Employment concentration of non-market services has slightly decreased since 2008 in the EU as a whole but has increase marginally in CEE. The agriculture, industry, financial, and business services sectors remain relatively concentrated in the EU. Agriculture and industry are more concentrated within the EU-15 than within the CEEs but the opposite is true for financial and business services. Construction activities have become relatively dispersed in the EU, but still less in the EU15 than in the CEEs. Trade, accommodation and food services, transport as well as non-market services are the least concentrated sectors in the EU. Also within the EU-15 and the CEEs, they are relatively evenly dispersed across regions.

This descriptive empirical study leaves scope for further research. The observed developments occurred over a specific time period, with the crisis resulting in most parts of our results in a structural break from the gradual processes like structural change or transformation. Also, in this paper, we only examine the first years after the crisis. The data sets only partially include the second economic dip around 2012 linked to the sovereign debt crisis. Future research could thus extend the database to analyse how lasting the crisis impact was. In addition, further research could focus on the analysis of specific regions, such as capital regions or border regions. It would also be interesting to focus on specific features of sectors, such as tradable vs. non-tradable sectors or capital- vs. labour intensive sectors. The rich database would also allow for a country/sector specific analysis, comparing countries with different policy settings and business conditions. Moreover, the implications for concentration and specialisation of policy measures during the crisis, like temporary employment schemes, could be analysed further.

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ANNEX

Addressing data gaps and regional delineation

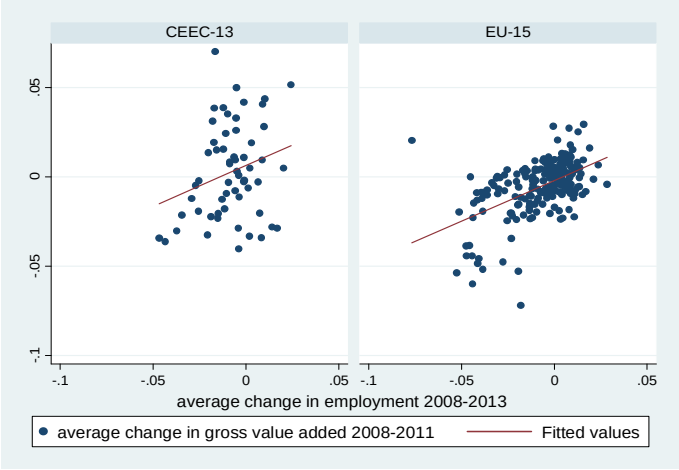
We address data gaps in the source data in order to construct strongly balanced panel data. At the detailed regional level, all datasets contained certain missing data on sector specific employment or gross value added. These data gaps are closed as carefully as possible. First, information at the aggregated sectoral or regional level was used to close gaps. Next, we used also regional employment shares per sector from other datasets to fill data holes. In some cases, we finally had to interpolate and extrapolate data series to close remaining gaps.

We evaluate our approach to deal with missing data in the source data and conclude that inevitable, but very limited errors remain. In order to evaluate our approach to deal with gaps in the different data sources, we compare total employment at the country level, resp. total gross value added, reported in the dataset with the total based on a bottom-up calculation. Differences between both concepts remain relatively well contained for the majority of countries.([27])

Regional delineation – the MAUP problem

The "Modifiable Area Unit Problem" or MAUP is likely to bias our regional analysis. Our results may by influenced by the choice of geographical boundaries ([28]). The administrative delineation of regions is arbitrary and not supported by economic underpinning. In order to test the sensitivity of our conclusions, we perform our analysis at different spatial scale levels (NUTS-1 to NUTS-3) if data is available. A similar problem arises with the NACE classification of sectors.

Graph A.1: **Gross value added and employment growth**



Source: Labour Force Survey (employment), Branch Accounts (gross value added), own calculations

([27]) Absolute differences between both concepts in employment data are below 1%. For the branch accounts, the difference in employment totals is even only 0.3%. Regarding gross value added differences are larger. Bottom-up totals are about 10% lower than the officially reported total gross value added (in 2010 basic prices). However, the difference is very stable over time.

([28]) See e.g. the ESPON Scientific Support Project 3.4.3: https://www.espon.eu/programme/projects/espon-2006/studies-and-scientific-support-projects/modifiable-areas-unit-problem

Table A.1: **Overview of the manufacturing sector according to the level of technological sophistication**

Low-tech manufacturing	manufacturing of food products, beverages and tobacco (NACE 10-11-12); textiles and clothing (NACE 13-14); leather and leather products (NACE 15); wood and wood products (NACE 16); pulp, paper and paper products (NACE 17); publishing and printing (NACE 18); furniture (NACE 31)
Medium low-tech manufacturing	manufacturing of coke, refined petroleum products and nuclear fuel (NACE 19); rubber and plastic products (NACE 22); non-metallic mineral products (NACE 23); basic metals and fabricated metal products (NACE 24-25); repair and installation of machinery and equipment (NACE 33)
Medium high-tech manufacturing	manufacturing of chemicals, chemical products and man-made fibres (NACE 20); machinery and equipment (NACE 28); transport equipment (NACE 29-30)
High-tech manufacturing	manufacturing of electrical and optical equipment (NACE 26-27); basic pharmaceutical products and pharmaceutical preparations (NACE 21)

Source: Eurostat

Table A.2: **Detailed sector disaggregation according to NACE Rev.2**

Section	Title
A	Agriculture, forestry and fishing
B	Mining and quarrying
C	Manufacturing
D	Electricity, gas, steam and air conditioning supply
E	Water supply; sewerage, waste management and remediation activities
F	Construction
G	Wholesale and retail trade; repair of motor vehicles and motorcycles
H	Transportation and storage
I	Accommodation and food service activities
J	Information and communication
K	Financial and insurance activities
L	Real estate activities
M	Professional, scientific and technical activities
N	Administrative and support service activities
O	Public administration and defence; compulsory social security
P	Education
Q	Human health and social work activities
R	Arts, entertainment and recreation
S	Other service activities
T	Activities of households as employers; undifferentiated activities of households as employers; undifferentiated goods- and services-producing activities of households for own use
U	Activities of extraterritorial organisations and bodies

Source: Eurostat

Table A.3: **Regional disaggregation, category according to average annual employment growth 2008-2013**

EU-28	NUTS2		
crid	**region**	**average annual employment growth 2008-2013**	**performance quartile**
LV00	Latvija	-6.50%	lower quartile
LT00	Lietuva	-6.10%	lower quartile
BG31	Severozapaden	-5.50%	lower quartile
RO31	Sud - Muntenia	-5.40%	lower quartile
IE01	Border, Midland and Western	-5.20%	lower quartile
BG32	Severentsentralen	-5.10%	lower quartile
ES52	Comunidad Valenciana	-5.00%	lower quartile
RO12	Centru	-4.80%	lower quartile
ES13	Cantabria	-4.40%	lower quartile
IE02	Southern and Eastern	-4.40%	lower quartile
ES42	Castilla-la Mancha	-4.10%	lower quartile
ES12	Principado de Asturias	-3.90%	lower quartile
ES53	Illes Balears	-3.90%	lower quartile
BG34	Yugoiztochen	-3.80%	lower quartile
PT15	Algarve	-3.80%	lower quartile
ES61	Andalucía	-3.80%	lower quartile
EL11	Anatoliki Makedonia, Thraki	-3.70%	lower quartile
ES11	Galicia	-3.60%	lower quartile
EL12	Kentriki Makedonia	-3.60%	lower quartile
ES24	Aragón	-3.60%	lower quartile
ES62	Región de Murcia	-3.50%	lower quartile
EL25	Peloponnisos	-3.40%	lower quartile
ES70	Canarias (ES)	-3.40%	lower quartile
ES51	Cataluña	-3.30%	lower quartile
ES22	Comunidad Foral de Navarra	-3.20%	lower quartile
EL14	Thessalia	-3.10%	lower quartile
ES43	Extremadura	-3.10%	lower quartile
ES21	País Vasco	-3.00%	lower quartile
EL30	Attiki	-3.00%	lower quartile
ES23	La Rioja	-3.00%	lower quartile
ES41	Castilla y León	-2.80%	lower quartile
EL24	Sterea Ellada	-2.80%	lower quartile
PT18	Alentejo	-2.80%	lower quartile
ES30	Comunidad de Madrid	-2.70%	lower quartile

(Continued on the next page)

Table (continued)

EL22	Ionia Nisia	-2.60%	lower quartile
EE00	Eesti	-2.60%	lower quartile
PT30	Região Autónoma da Madeira (PT)	-2.50%	lower quartile
EL43	Kriti	-2.40%	lower quartile
SI01	Vzhodna Slovenija	-2.40%	lower quartile
BG33	Severoiztochen	-2.40%	lower quartile
PT11	Norte	-2.20%	lower quartile
ITF3	Campania	-2.10%	lower quartile
DK05	Nordjylland	-2.10%	lower quartile
DK04	Midtjylland	-2.10%	lower quartile
DK03	Syddanmark	-2.00%	lower quartile
UKM6	Highlands and Islands	-1.90%	lower quartile
EL13	Dytiki Makedonia	-1.90%	lower quartile
ITF2	Molise	-1.90%	lower quartile
EL21	Ipeiros	-1.80%	lower quartile
BG42	Yuzhen tsentralen	-1.80%	lower quartile
CZ07	Střední Morava	-1.70%	lower quartile
ITF5	Basilicata	-1.70%	lower quartile
CZ08	Moravskoslezsko	-1.70%	lower quartile
PT16	Centro (PT)	-1.60%	lower quartile
DK02	Sjælland	-1.60%	lower quartile
RO22	Sud-Est	-1.60%	lower quartile
UKM3	South Western Scotland	-1.60%	lower quartile
HU23	Dél-Dunántúl	-1.50%	lower quartile
UKC1	Tees Valley and Durham	-1.50%	lower quartile
EL23	Dytiki Ellada	-1.40%	lower quartile
PL52	Opolskie	-1.40%	lower quartile
PL11	Lódzkie	-1.40%	lower quartile
ITF4	Puglia	-1.40%	lower quartile
SI02	Zahodna Slovenija	-1.40%	lower quartile
PT20	Região Autónoma dos Açores (PT)	-1.30%	lower quartile
PT17	Lisboa	-1.30%	lower quartile
ES63	Ciudad Autónoma de Ceuta (ES)	-1.30%	lower interquartile range
UKG2	Shropshire and Staffordshire	-1.20%	lower interquartile range
UKF3	Lincolnshire	-1.20%	lower interquartile range
SE32	Mellersta Norrland	-1.20%	lower interquartile range
CZ06	Jihovýchod	-1.10%	lower interquartile range
EL41	Voreio Aigaio	-1.10%	lower interquartile range

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Table (continued)

PL62	Warminsko-Mazurskie	-1.10%	lower interquartile range
ES64	Ciudad Autónoma de Melilla (ES)	-1.10%	lower interquartile range
DK01	Hovedstaden	-1.10%	lower interquartile range
ITG1	Sicilia	-1.00%	lower interquartile range
CZ05	Severovýchod	-1.00%	lower interquartile range
BG41	Yugozapaden	-1.00%	lower interquartile range
NL13	Drenthe	-1.00%	lower interquartile range
FR23	Haute-Normandie	-1.00%	lower interquartile range
CZ03	Jihozápad	-1.00%	lower interquartile range
PL32	Podkarpackie	-0.90%	lower interquartile range
FR63	Limousin	-0.90%	lower interquartile range
FR22	Picardie	-0.90%	lower interquartile range
ITH4	Friuli-Venezia Giulia	-0.90%	lower interquartile range
NL33	Zuid-Holland	-0.90%	lower interquartile range
FR41	Lorraine	-0.90%	lower interquartile range
UKK2	Dorset and Somerset	-0.80%	lower interquartile range
FR26	Bourgogne	-0.80%	lower interquartile range
UKG1	Herefordshire, Worcestershire and Warwi	-0.80%	lower interquartile range
UKD1	Cumbria	-0.80%	lower interquartile range
FI1C	Etelä-Suomi	-0.80%	lower interquartile range
ITI2	Umbria	-0.80%	lower interquartile range
ITF1	Abruzzo	-0.70%	lower interquartile range
FI20	Åland	-0.70%	lower interquartile range
FR21	Champagne-Ardenne	-0.70%	lower interquartile range
NL11	Groningen	-0.70%	lower interquartile range
UKM2	Eastern Scotland	-0.70%	lower interquartile range
ITI1	Toscana	-0.70%	lower interquartile range
ITC4	Lombardia	-0.70%	lower interquartile range
SK02	Západné Slovensko	-0.60%	lower interquartile range
SE21	Småland med öarna	-0.60%	lower interquartile range
FR43	Franche-Comté	-0.60%	lower interquartile range
FI1B	Helsinki-Uusimaa	-0.60%	lower interquartile range
UKK3	Cornwall and Isles of Scilly	-0.60%	lower interquartile range
RO42	Vest	-0.60%	lower interquartile range
SK04	Východné Slovensko	-0.60%	lower interquartile range
CZ04	Severozápad	-0.60%	lower interquartile range
HU10	Közép-Magyarország	-0.60%	lower interquartile range
UKE4	West Yorkshire	-0.60%	lower interquartile range

(Continued on the next page)

Table (continued)

NL22	Gelderland	-0.60%	lower interquartile range
FR72	Auvergne	-0.60%	lower interquartile range
ITC1	Piemonte	-0.50%	lower interquartile range
CZ01	Praha	-0.50%	lower interquartile range
ITI3	Marche	-0.50%	lower interquartile range
UKD6	Cheshire	-0.50%	lower interquartile range
SK03	Stredné Slovensko	-0.50%	lower interquartile range
FR25	Basse-Normandie	-0.50%	lower interquartile range
ITH5	Emilia-Romagna	-0.50%	lower interquartile range
ITG2	Sardegna	-0.50%	lower interquartile range
ITH3	Veneto	-0.50%	lower interquartile range
UKL2	East Wales	-0.40%	lower interquartile range
SE31	Norra Mellansverige	-0.40%	lower interquartile range
FR24	Centre (FR)	-0.40%	lower interquartile range
NL42	Limburg (NL)	-0.40%	lower interquartile range
ITF6	Calabria	-0.40%	lower interquartile range
PL51	Dolnoslaskie	-0.40%	lower interquartile range
UKF1	Derbyshire and Nottinghamshire	-0.40%	lower interquartile range
HU21	Közép-Dunántúl	-0.40%	lower interquartile range
UKE1	East Yorkshire and Northern Lincolnshire	-0.40%	lower interquartile range
UKK4	Devon	-0.30%	lower interquartile range
SK01	Bratislavský kraj	-0.30%	lower interquartile range
UKL1	West Wales and The Valleys	-0.30%	upper interquartile quartile
NL41	Noord-Brabant	-0.30%	upper interquartile quartile
UKK1	Gloucestershire, Wiltshire and Bristol/Bath	-0.30%	upper interquartile quartile
HU32	Észak-Alföld	-0.30%	upper interquartile quartile
DE80	Mecklenburg-Vorpommern	-0.30%	upper interquartile quartile
NL12	Friesland (NL)	-0.30%	upper interquartile quartile
ITC3	Liguria	-0.30%	upper interquartile quartile
FR30	Nord - Pas-de-Calais	-0.30%	upper interquartile quartile
UKJ4	Kent	-0.30%	upper interquartile quartile
UKF2	Leicestershire, Rutland and Northamptons	-0.30%	upper interquartile quartile
PL34	Podlaskie	-0.30%	upper interquartile quartile
DED4	Chemnitz	-0.20%	upper interquartile quartile
UKG3	West Midlands	-0.20%	upper interquartile quartile
UKD4	Lancashire	-0.20%	upper interquartile quartile
FR42	Alsace	-0.20%	upper interquartile quartile
NL23	Flevoland	-0.20%	upper interquartile quartile

(Continued on the next page)

Table (continued)

FR53	Poitou-Charentes	-0.20%	upper interquartile quartile
NL32	Noord-Holland	-0.20%	upper interquartile quartile
DEE0	Sachsen-Anhalt	-0.20%	upper interquartile quartile
HU33	Dél-Alföld	-0.10%	upper interquartile quartile
PL42	Zachodniopomorskie	-0.10%	upper interquartile quartile
CY00	Kypros	-0.10%	upper interquartile quartile
HU31	Észak-Magyarország	0.00%	upper interquartile quartile
FI1D	Pohjois- ja Itä-Suomi	0.00%	upper interquartile quartile
UKJ1	Berkshire, Buckinghamshire and Oxfordsł	0.00%	upper interquartile quartile
FI19	Länsi-Suomi	0.00%	upper interquartile quartile
FR51	Pays de la Loire	0.00%	upper interquartile quartile
FR10	Île de France	0.00%	upper interquartile quartile
RO32	Bucuresti - Ilfov	0.00%	upper interquartile quartile
SE23	Västsverige	0.00%	upper interquartile quartile
NL34	Zeeland	0.00%	upper interquartile quartile
CZ02	Střední Cechy	0.10%	upper interquartile quartile
ITI4	Lazio	0.10%	upper interquartile quartile
UKJ3	Hampshire and Isle of Wight	0.10%	upper interquartile quartile
AT21	Kärnten	0.10%	upper interquartile quartile
BE25	Prov. West-Vlaanderen	0.10%	upper interquartile quartile
HU22	Nyugat-Dunántúl	0.20%	upper interquartile quartile
SE12	Östra Mellansverige	0.20%	upper interquartile quartile
FR52	Bretagne	0.20%	upper interquartile quartile
FR82	Provence-Alpes-Côte d'Azur	0.20%	upper interquartile quartile
FR71	Rhône-Alpes	0.20%	upper interquartile quartile
BE24	Prov. Vlaams-Brabant	0.20%	upper interquartile quartile
UKC2	Northumberland and Tyne and Wear	0.20%	upper interquartile quartile
DE11	Stuttgart	0.20%	upper interquartile quartile
FR61	Aquitaine	0.20%	upper interquartile quartile
DEB1	Koblenz	0.20%	upper interquartile quartile
NL31	Utrecht	0.20%	upper interquartile quartile
UKE3	South Yorkshire	0.20%	upper interquartile quartile
FR62	Midi-Pyrénées	0.30%	upper interquartile quartile
DE12	Karlsruhe	0.30%	upper interquartile quartile
UKD3	Greater Manchester	0.30%	upper interquartile quartile
AT12	Niederösterreich	0.30%	upper interquartile quartile
DEG0	Thüringen	0.30%	upper interquartile quartile
FR81	Languedoc-Roussillon	0.30%	upper interquartile quartile

(Continued on the next page)

Table (continued)

NL21	Overijssel	0.30%	upper interquartile quartile
PL12	Mazowieckie	0.30%	upper interquartile quartile
DE50	Bremen	0.30%	upper interquartile quartile
SE33	Övre Norrland	0.30%	upper interquartile quartile
DEA1	Düsseldorf	0.30%	upper interquartile quartile
DED2	Dresden	0.30%	upper interquartile quartile
PL21	Malopolskie	0.30%	upper interquartile quartile
AT31	Oberösterreich	0.30%	upper interquartile quartile
ITC2	Valle d'Aosta/Vallée d'Aoste	0.30%	upper interquartile quartile
ITH2	Provincia Autonoma di Trento	0.40%	upper interquartile quartile
UKN0	Northern Ireland (UK)	0.40%	upper interquartile quartile
SE22	Sydsverige	0.40%	upper interquartile quartile
DEC0	Saarland	0.40%	upper interquartile quartile
UKJ2	Surrey, East and West Sussex	0.40%	upper quartile
UKD7	Merseyside	0.40%	upper quartile
BE21	Prov. Antwerpen	0.50%	upper quartile
BE32	Prov. Hainaut	0.50%	upper quartile
DE14	Tübingen	0.50%	upper quartile
UKH2	Bedfordshire and Hertfordshire	0.50%	upper quartile
DE13	Freiburg	0.50%	upper quartile
DEA5	Arnsberg	0.50%	upper quartile
DE26	Unterfranken	0.50%	upper quartile
PL31	Lubelskie	0.50%	upper quartile
AT22	Steiermark	0.60%	upper quartile
BE33	Prov. Liège	0.60%	upper quartile
DE91	Braunschweig	0.60%	upper quartile
DEB2	Trier	0.60%	upper quartile
UKH3	Essex	0.60%	upper quartile
DEA4	Detmold	0.60%	upper quartile
AT32	Salzburg	0.60%	upper quartile
UKE2	North Yorkshire	0.70%	upper quartile
DEF0	Schleswig-Holstein	0.70%	upper quartile
AT13	Wien	0.70%	upper quartile
DE71	Darmstadt	0.70%	upper quartile
DE72	Gießen	0.70%	upper quartile
UKI2	Outer London	0.70%	upper quartile
DE40	Brandenburg	0.70%	upper quartile
DE92	Hannover	0.70%	upper quartile

(Continued on the next page)

Table (continued)

DEB3	Rheinhessen-Pfalz	0.70%	upper quartile
DED5	Leipzig	0.70%	upper quartile
DE93	Lüneburg	0.80%	upper quartile
DE24	Oberfranken	0.80%	upper quartile
BE22	Prov. Limburg (BE)	0.80%	upper quartile
BE23	Prov. Oost-Vlaanderen	0.80%	upper quartile
RO41	Sud-Vest Oltenia	0.80%	upper quartile
DEA3	Münster	0.80%	upper quartile
ITH1	Provincia Autonoma di Bolzano/Bozen	0.90%	upper quartile
DEA2	Köln	0.90%	upper quartile
BE10	Brussels	0.90%	upper quartile
AT11	Burgenland (AT)	0.90%	upper quartile
AT33	Tirol	0.90%	upper quartile
DE25	Mittelfranken	0.90%	upper quartile
DE73	Kassel	1.00%	upper quartile
BE34	Prov. Luxembourg (BE)	1.00%	upper quartile
DE27	Schwaben	1.00%	upper quartile
SE11	Stockholm	1.00%	upper quartile
DE23	Oberpfalz	1.10%	upper quartile
DE22	Niederbayern	1.10%	upper quartile
AT34	Vorarlberg	1.10%	upper quartile
UKI1	Inner London	1.10%	upper quartile
DE60	Hamburg	1.20%	upper quartile
PL63	Pomorskie	1.20%	upper quartile
UKH1	East Anglia	1.30%	upper quartile
MT00	Malta	1.30%	upper quartile
PL43	Lubuskie	1.30%	upper quartile
DE21	Oberbayern	1.30%	upper quartile
BE31	Prov. Brabant Wallon	1.30%	upper quartile
UKM5	North Eastern Scotland	1.30%	upper quartile
RO11	Nord-Vest	1.40%	upper quartile
BE35	Prov. Namur	1.50%	upper quartile
PL33	Swietokrzyskie	1.50%	upper quartile
DE94	Weser-Ems	1.60%	upper quartile
DE30	Berlin	1.60%	upper quartile
RO21	Nord-Est	1.80%	upper quartile
LU00	Luxembourg	1.90%	upper quartile
PL61	Kujawsko-Pomorskie	2.60%	upper quartile

(Continued on the next page)

Table (continued)

PL41	Wielkopolskie	2.70%	upper quartile
PL22	Slaskie	2.80%	upper quartile
FR83	Corse	3.10%	upper quartile

Source: Eurostat and own calculations

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