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Regional resilience across Europe: on urbanisation and the initial impact of the Great Recession

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Using a novel data set for 207 European regions from 22 different countries, we analyse the relevance of urbanisation for the short-term resilience to a major shock. We take the Great Recession, the economic and financial crisis that started in 2008, as our shock and analyse how the European NUTS 2 regions differ in their short-run resilience in the aftermath to the crisis in terms of unemployment and real GDP per capita. We find that the degree and nature of regional urbanisation is important for resilience. EU regions with a relatively large share of the population in commuting areas are relatively more resilient. In addition, regions with a large output share in medium-high tech industries were also less affected by the crisis.

Keywords: resilience, Great Recession, urbanisation, sectoral composition
JEL Classifications: R11, R12, R15

Introduction

Some regions are more resilient than other regions when confronted with economic shocks. These regions are less affected by such shocks on impact in the short-run and/or they recover more quickly in the long run. A prime example of a major economic shock is the economic and financial crisis that began in 2008, which turned into what is now labelled 'The Great Recession'. The literature on the meaning, causes and consequences of regional resilience has grown fast in recent years, see for a survey the 2010 special issue of *The Cambridge Journal of Regions, Economy and Society* on *The Resilient Region*. From an empirical perspective, it is by now well established that regions differ in their resilience in terms of regional growth or (un)employment. Fingleton et al. (2012, 2015), for instance, find considerable differences in regional resilience as measured by employment patterns for the UK and EMU regions, respectively. Evidence into the determinants of regional resilience is however rather scarce (see Gardiner et al., 2013, for an exception for the UK) and when it exists, it is confined to regions within a single country.

For the 2008 crisis, it is clear that the impact of the crisis varies across the EU regions (see Groot et al., 2011), but systematic evidence why the impact of the crisis varied across Europe and what might account for these variations is still lacking. It is here that the present paper comes in. There are two contributions of the paper to the literature on regional resilience. First, we provide systematic evidence for the years 2008–2012 on how the crisis impacted differently for 207 European NUTS 2 regions from 22 different countries (see Table 1) by looking at regional unemployment and GDP differences. Second, and more importantly, we relate regional resilience for the 2008 crisis, or more precisely the initial (2008–2012) resistance to the shock, to the degree and pattern of urbanisation within each of the 207 regions. In doing so, we take as our basic starting point the main premise underlying urban economics that urbanisation matters for a region's economic performance. In addition, we combine the data on urbanisation with the sector composition of regions.[1] The sector composition of a region's economy is traditionally thought to be a key determinant of regional growth and employment, and thus possibly also a co-determinant of resilience.

We will first link regional resilience to the degree and nature of regional urbanisation. A relatively new data set allows us to do so. There is a large body of literature (see, for example, Duranton and Puga, 2014 or Glaeser and Kahn, 2004) in urban and regional economics, which links regional growth to the degree of regional urbanisation. Both the size of the population (agglomeration) and the specialisation pattern of a region are seen as being among the most important determinants of regional growth. Regions that have a more skilled population or work force, which is employed in skill-intensive sectors, do perform better and, by and large, regions that are more urbanised do outperform less urbanised regions. Various forms of agglomeration economies that are as such hard to measure are thought of as being summarised by the degree of urbanisation, including the availability of human capital.

The possible relevance of the degree, skill composition and sector specialisation of urbanised regions for resilience is to be found in the fact that urbanisation also signals the degree to which cities or regions are able to adjust to shocks (see, for example, Glaeser, 2005, for a detailed study on the resilience of Boston, or Martin et al., 2013, for French clusters). Furthermore, Martin et al. (2013) show that firms in clusters have a higher probability to survive a crises and have higher growth rates; from the map in their paper one can conclude that clusters and cities can be found in the same areas (Figure 1, 4). We will use urbanisation data for the NUTS 2 regions to assess whether the degree of urbanisation may be associated with a region's plight in the wake of the Great Recession. To be clear from the outset as to what we are able to do when it comes to the analysis of resilience, we focus on

Table 1. *Overview of European countries and regions included in the analysis.*

Country	No. of regions
Austria	8
Belgium	11
Czech Republic	8
Denmark	3
Estonia	1
Finland	1
France	21
Germany	34
Hungary	7
Ireland	2
Italy	12
Latvia	1
Lithuania	1
Luxembourg	1
Malta	1
Netherlands	12
Norway	6
Poland	16
Portugal	5
Slovakia	4
Spain	19
UK	33

Total number of regions: 207 (from 22 different countries).

the initial or 'resistance' phase following a shock as our data only cover the period 2008–2012. A region's resilience is also determined by the subsequent recovery phase (Martin, 2012) that may take many years and is not covered by our data set, if only because the recovery from the 2008 crisis is still an ongoing process.

After we have looked into the relevance of urbanisation and the sector composition separately, we will also test for the joint effect of urbanisation and sector composition on regional unemployment and real GDP per capita for the NUTS 2 EU regions for 2008–2012. The reason is that urbanisation and sector composition are possibly two sides of the same coin in the sense that more urbanisation goes along with more specialisation.[2] In 'The joint effects of urbanisation and sectoral composition' section, we will test for this joint effect, that is, the combination of sector composition and urbanisation.

Our main finding is that EU regions with a relatively large share of their population in commuting areas are relatively resilient in the period 2008–2012. In contrast, regions with a large share of their people living in rural areas or cities were more impacted by the 2008 crisis shock. In addition, sectoral composition matters as well, regions with a larger share of output in medium and high tech industries were less affected in the aftermath of the crisis during the period 2008–2012.

The paper is structured as follows. The next section focuses on the relationship between urbanisation and unemployment using NUTS 2 data for 2008–2012 for the EU regions. The following section does the same regarding the relationship between sector specialisation and unemployment. The paper then analyses the joint effects of both urbanisation and sector composition before briefly repeating the analysis regarding the role of urbanisation and sectors during the Great Recession by using real GDP (both total and per capita) as an indicator, rather than unemployment. The final section concludes.

Regional unemployment and urbanisation

We use new urbanisation data set from Eurostat (kindly provided to us by Lewis Dijkstra—Eurostat—and Dirk Stelder) for 283 NUTS 2 regions (see Dijkstra and Poelman, 2012 for the city and other regional definitions used for this data set). We can connect this to unemployment level information for up to 271 regions.[3] Note that the corresponding employment data are at this moment (January 2015) only available until 2008, which makes these data less suitable for this paper. Employment has been used to assess a region's resilience to shocks (Fingleton et al., 2012, 2015), but at the spatial or urbanisation level used in this paper, these employment data do not exist (yet) for the post-2008 period. Starting from 2008, the regional unemployment level increases on average by about 30%, 9%, 1% and 7% in 2009, 2010, 2011 and 2012, respectively, see Figure 1. Measured this way, the Great Recession continues throughout this period, although the effect is small in 2011. The *cumulative* effect since the start of the crisis (2008), measured as the average change in unemployment since 2008, rises uninterrupted at 30%, 42%, 44% and 56% in 2009, 2010, 2011 and 2012, respectively.

Our urbanisation information for the NUTS 2 regions as available from Eurostat focuses on three types of urbanisation indicators for each NUTS 2 region (see Dijkstra and Poelman, 2012):

(i) The population living in *cities*, in the Eurostat data set used in this paper, where cities are defined as municipalities where at least 50% of the population of a so-called urban centre actually lives. An urban centre is built upon a grid analysis of population density (persons per km^2) and where an urban centre is a cluster of adjacent grids with at least 50,000 inhabitants;
(ii) The population living in *commuting areas*, where commuting areas are defined as those municipalities that are not classified as cities and where 'at least 15% of the workforce' works outside this area and in a city.

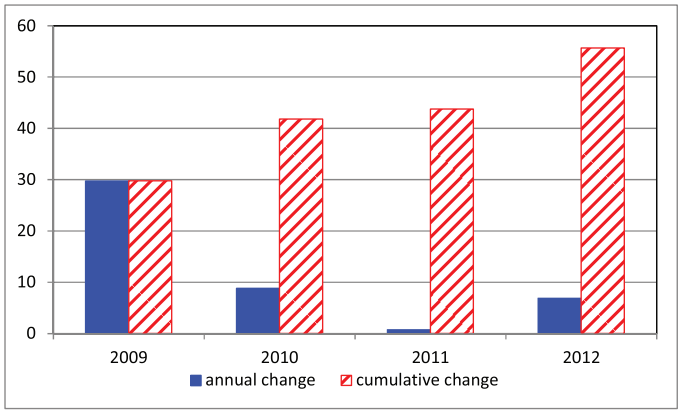

Figure 1. *Average change in unemployment since 2008 (%).*

(iii) The population living outside cities and commuting areas are labelled 'rural' population.

So for each NUTS 2 region in our sample, the information on (i)–(iii) gives the distribution of the population across these 3 categories of locations within each NUTS 2 region. We can combine our regional information on urbanisation and economic characteristics with the sectoral input–output information (see below) for 207 European regions from 22 different countries, see Table 1. The remainder of the analysis therefore focuses on these 207 regions. On average across our sample of NUTS 2 regions, the share of people living in cities is 24.4% and the share living in commuting zones is 37.1%, so the share living in rural areas is 38.5%.[4]

To assess the impact of a region's urbanisation pattern as summarised by categories (i)–(iii), *on* regional unemployment resilience that is to say on the resistance to or, equivalently, the initial impact of the 2008 crisis, we first ran a series of univariate regressions with the relative change in a region's unemployment level as the variable to be explained, both annually and cumulatively since 2008, and regressed on the share of the population (in %) living in cities, commuting areas, rural areas or urbanised areas (either cities or commuting areas, *cit* + *com*) as explanatory variables.

Figure 2 provides information on the coefficients for the various regressions: panel 2*a* for the annual changes and panel 2*b* for the cumulative changes. Note the vertical axis depicts *estimated coefficients*. In general, a high share of the region's population living in cities worsens the regional impact of the crisis in terms of higher unemployment. In 2009, for example, a 10% higher share of the population living in cities is associated with a 1.36% *higher* change in unemployment. This effect of the city population on unemployment becomes smaller in 2010, increases in 2011 and reverses in 2012. The cumulative effect of the city population therefore rises from 2009 to 2011 and reaches a peak in 2011. *But none of these effects is statistically significant*. Rural areas seem to have a delayed, but similar impact during the crisis. The initial annual effect (in 2009) is negative, whereas the subsequent annual effects are positive, indicating that unemployment rises faster for rural areas. These effects are (just) significant in 2011 and 2012. Note that the *cumulative* impact of rural areas therefore rises over time, but these effects are not statistically significant (see subsequent analysis for some significant cumulative effects).

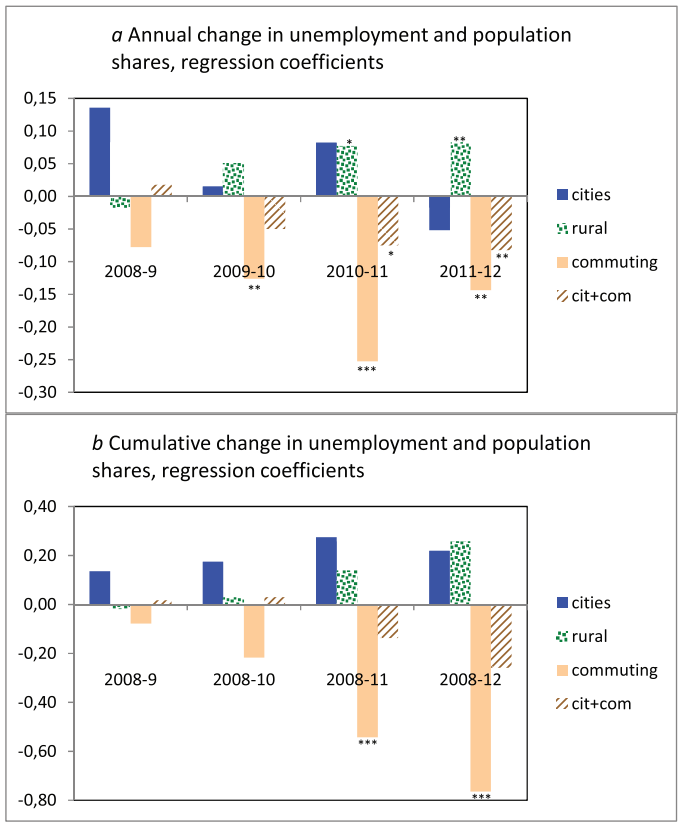

Figure 2. *Change in unemployment and urbanisation: regression coefficients.*
Notes: *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

This brings us to the impact of the share of the region's population living in commuting areas. Panel 2*a* indicates that the annual impact is always negative and except for the initial year also significant, indicating that *unemployment rose less fast for commuting areas*. In 2011, for example, a 1% higher share of the region's population living in commuting areas leads to a 0.25% *lower* change in unemployment. Panel 2*b* indicates that the cumulative effect on unemployment therefore rises over time. From 2011 onwards, the cumulative effect of the commuting population is highly significant at the 1% level (none of the other cumulative effects are significant). In 2012, a 1% higher share of the population living in commuting areas *lowers* the cumulative change in unemployment by 0.76%.

Figure 2 also illustrates that it is not proper to merge the city population together with the commuting population because the negative coefficient for the commuting population is partially cancelled by the positive coefficient for the city population. The net effect is, of course, the mirror image of that of the share of the rural population. The reason for higher resilience to the initial impact of the 2008 crisis in areas with a large share of commuting areas can be manifold: these areas can be home to a more mobile workforce, the workforce can be relatively high skilled (and less susceptible for unemployment) or these areas are attractive for location of a specific type of firm. The latter explanation is consistent with the findings of Martin et al. (2013) who find that clusters of

exporting firms—near cities, are more resilient than areas that do not have such clusters (see also 'The joint effects of urbanisation and sectoral composition' section for a similar line of reasoning).

Figure 3 summarises the share of the variance in the relative change of unemployment explained by the regressions. Panel 3*a* does so for annual changes and panel 3*b* for the cumulative effects. Not surprisingly in these types of cross-section regressions, the explanatory power of a single variable is limited. In both panels, however, the impact of the share of commuting population clearly dominates that of the other effects. Figure 4 provides an example of the relationship between the relative change in unemployment in the year 2011 and the share of the population living in cities. Two illustrative examples are (Greek) Macedonia, where the share of the commuting population is 0% and the increase in unemployment is 50%, and (Belgian) Brabant Wallon, where the share of the commuting population is 100% and the fall in unemployment is 22%. An outlier in this respect is given by Madeira.

These univariate regressions give a first indication that urbanisation, or more precisely, the within-region population distribution across cities, commuting areas and rural areas may matter for the initial impact of the Great Recession in terms of regional unemployment. The basic reason why this could be the case is to be found in the key premise underlying urban economics or economic geography at large that

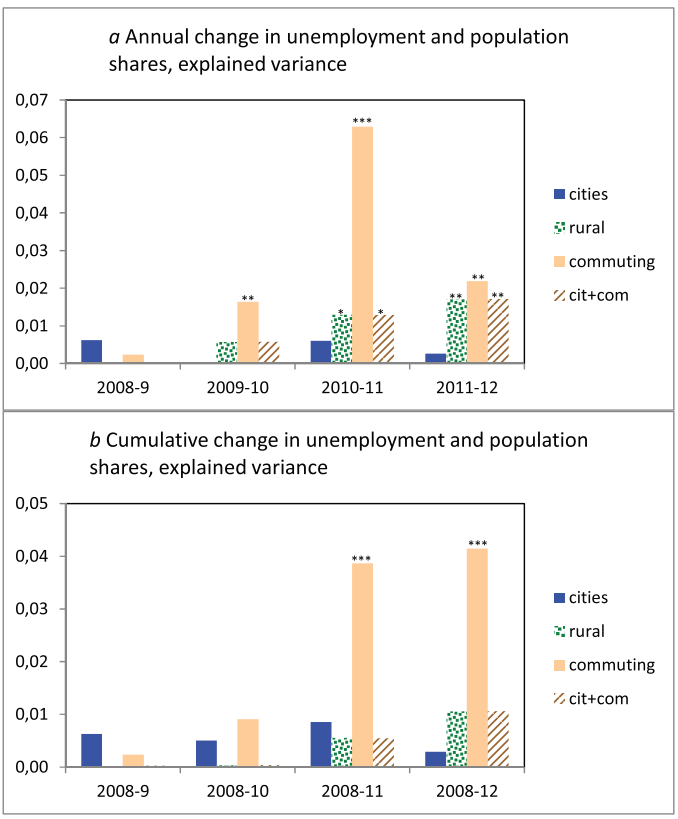

Figure 3. *Change in unemployment and urbanisation: explained variance.*
Notes: *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively.

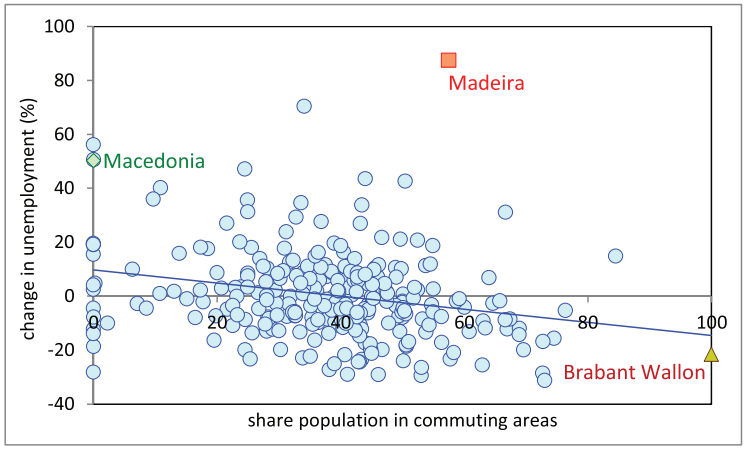

Figure 4. *Change in unemployment and share of population in commuting areas, 2011.*

the spatial allocation of the population matter for economic outcomes. At the same time, the findings in this section are only preliminary in the sense that we need to see if they hold if we allow for competing explanations as to why the 2008 crisis has a different initial impact across European regions. This is what we will do next.

Regional unemployment and sector composition

We perform a similar annual and cumulative analysis of changes in regional unemployment in relation to the sectoral output composition of the regions for the NUTS 2 regions for 2008–2012. As we explained in our Introduction, a region's specialisation is a main candidate to explain why regions differ in their initial resilience to shocks like the Great Recession. To this end, we use the input–output information from Thissen et al. (2013a). We can match the unemployment data with the sectoral composition data for 207 EU NUTS 2 regions. Based on information from Thissen et al. (2013b), we identify six main sectors, together covering total regional output in 2008 as follows (codes refer to Thissen et al., 2013a; Table 3)[5]:

- Agri—*agriculture*; agriculture, hunting, forestry and fishing (AA01, AA02 and BA05).
- Food—*food*; food products and beverages (DA15).
- Lowtech—*low technology*; tobacco, textiles, wearing apparel, leather, wood, pulp, paper and printed matter (DA16, DB17, DB18, DC19, DD20, DE21 and DE22).
- Mehitec—*medium high technology*; chemical, electrical machinery, motor vehicles and other transport equipment (DG24, DL31, DM34 and DM35).
- Finbus—*financial and business services*; (services auxiliary to) financial intermediation, insurance and pension, computer services, research and development, other business services (JA65, JA66, JA67, KA72, KA73 and KA74).
- Other—all *other* output; all remaining categories.

Figure 5 summarises the regressions coefficients for the relative changes in regional unemployment as explained by the share (in %) of output in a certain sector, both annually (panel 5*a*) and cumulatively since 2008 (panel 5*b*). Figure 6 is similarly organised regarding the explained variance. The most important initial impact (in 2009, see Figures 5a and 6a) is the *rise* of unemployment of food-intensive regions. A 1% higher share of output in the food sector leads to a 1.64% *higher* change in

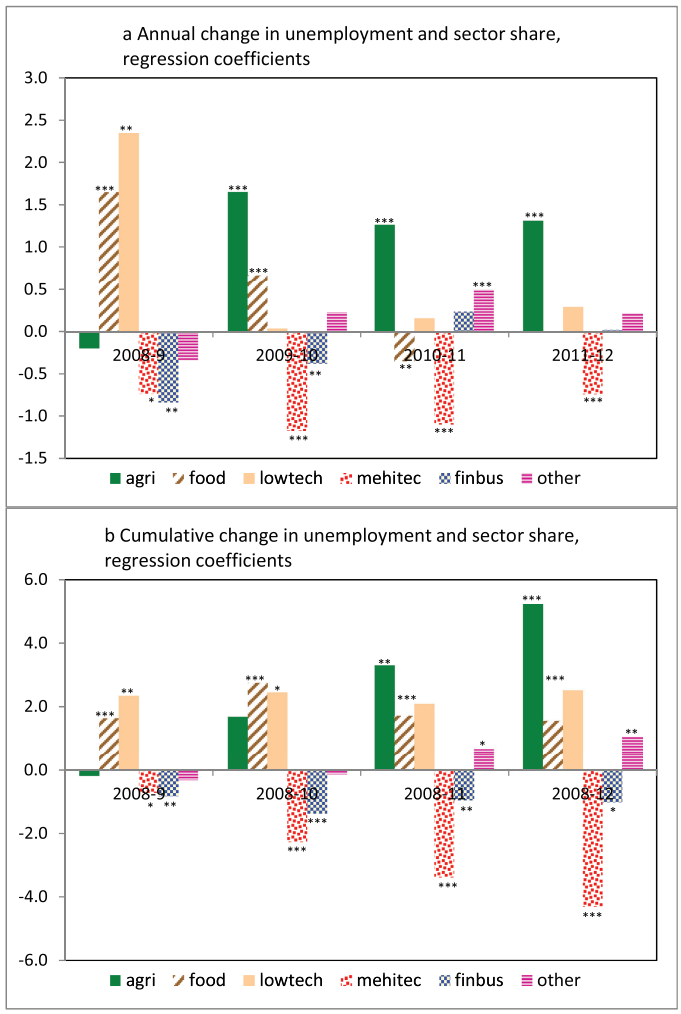

Figure 5. *Change in unemployment and sector share: regression coefficients.*
Notes: *, ** and *** indicate significance at the 10%, 5% and 1% level, respectively; agri = agriculture; lowtech = low technology sectors; mehitec = medium and high technology sectors; finbus = financial and business services.

unemployment. This explains about 12.4% of the variance of the change in unemployment (more on this below). In contrast, the other initially significant effects, namely higher unemployment for lowtech-intensive regions and lower unemployment for mehitech-intensive and finbus-intensive regions, only explain about 3% of the variance.

The initial impact of the crisis for the food-intensive regions in terms of raising unemployment continues in 2010, is reversed in 2011 and disappears in 2012. The cumulative effect remains, however, statistically significant throughout the entire period, but the share of explained variance falls to only 3.5% by 2012 (see Figures 5b and 6b). From 2010, the dominant sector effect on unemployment switches to the mehitec sector: in 2010, for example, a 1% higher share of output in the mehitec sector leads to a 1.17% *lower* rate in unemployment. Similar results

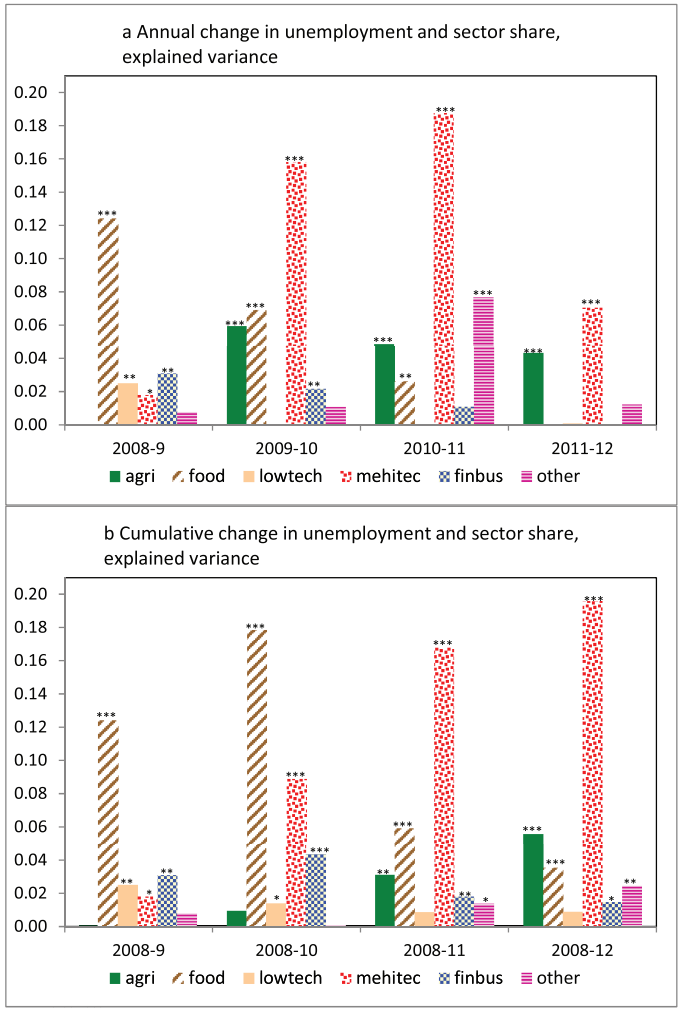

Figure 6. *Change in unemployment and sector share: explained variance.*
Notes: *, ** and *** indicate significance at the 10%, 5% and 1 % level, respectively; agri = agriculture; lowtech = low technology sectors; mehitec = medium and high technology sectors; finbus = financial and business services.

hold in 2011 and 2012. The cumulative impact of the mehitec sector thus rises over time, such that by 2010 a 1% *higher* share of output in the mehitec sector leads cumulatively to a 4.3% *lower* change in unemployment, which explains about 20% of the variance in unemployment. As can be seen in Figures 5 and 6, a *reverse* role is played by agriculture-intensive regions since 2010. In this case, a higher share of output in agriculture raises unemployment by more than 1% per year and by more than 5% cumulatively by 2012. The cumulative share of variance explained rises to almost 6% by 2012. The impact of other sectors is of second-order importance in comparison.

To give an impression of the relationship between the change in unemployment and the sectoral composition, Figure 7 gives two examples. Panel 7*a* illustrates the cumulative change in unemployment from 2008 to 2010 and the

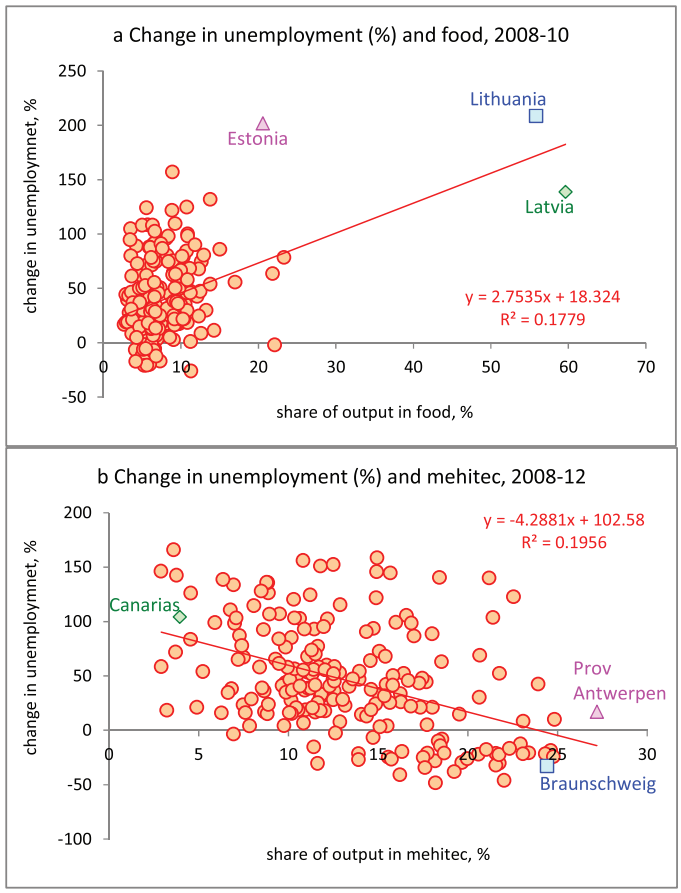

Figure 7. *Change in unemployment, food and medium-high tech.*

share of output in the food sector. This figure makes clear that the relatively strong relationship is essentially based on the high food shares in output of Lithuania (56%) and Latvia (60%), combined with a sharp rise in unemployment in these country regions (209% and 139%, respectively) in this period. Excluding these two regions would mean that food intensity is not very informative regarding the change in unemployment in the initial phase of the crisis.

Figure 7b illustrates the relative change in unemployment in the period 2008–2012 and the share of output in the mehitec sector. The contrast with panel 7*a* is that we now see a rather robust negative relationship, not caused by a few outliers. Typical examples are the Canary Islands of Spain (4% mehitec and 104% rise in unemployment), the Province of Antwerp in Belgium (27% mehitec and only 17% rise in unemployment) and Braunschweig of Germany (24% mehitec and a 33% *fall* in unemployment).

Regions with a relatively larger output share in the mehitec and finbus sectors coped thus relatively better initially with the Great Recession. These are also two important export sectors.[6] Sectors that are less well able to diversify their markets of destination and which are relatively more inward oriented, such as the agri/food and low tech industries are more susceptible for economic recessions. Although the sector definitions are not the same, Martin

et al. (2013, table A1, 17) find similar results for France using micro-firm data.

The joint effects of urbanisation and sectoral composition

Because both the degree of regional urbanisation (2nd section) and the sectoral composition (previous section) are empirically relevant to understand the changes in regional unemployment following the 2008 crisis, it is worthwhile to jointly investigate them. This is also appropriate because, as we explained in the Introduction, regional urbanisation and sectoral composition or specialisation are probably not independent. On a rather general level, we know for instance that more urbanised areas are more and differently specialised (see Brakman and van Marrewijk, 2013). Concentration of specific factors of production could determine specialisation patterns, which in turn determines regional resilience.[7]

Table 2 provides simple information on the correlation between output shares of the six identified sectors and the three types of population dwellings identified in the 2nd section. Within the output shares, we find the strongest *negative* correlations in the EU regions between the sectors *other & food*, *other & mehitec* and *finbus & lowtech*. The strongest *positive* correlations are between *agri & food*, *lowtech & mehitec* and *lowtech & agri*. Note that both the sectors *other* and *finbus* are negatively correlated with all other sectors. Within the three population types, we observe a surprisingly low positive correlation between the shares for *cities & commute*. In contrast, as expected, we observe a strong negative correlation between the shares for *rural & cities* and *rural & commute*.

When we look at the interaction between regional population and sectoral output, our main concern here, we observe the strongest positive correlations between *agri & rural* and *cities & finbus*, followed by slightly weaker, but still substantial, positive correlation between *rural & lowtech*, *commute & mehitec* and *commute & finbus*. The strongest negative correlations are between *cities & agri* and *commute & agri*, followed by slightly weaker, but still substantial, negative correlation between *cities & mehitec* and *commute & lowtech*.

On the basis of the above partial correlation results, we will now analyse the joint effects of the sectors *agri, food, lowtech, mehitec* and *finbus* (taking 'other' as benchmark) and the urbanisation categories *commuting* and *cities* (taking 'rural' as benchmark). As before, we will analyse the sectoral composition and urbanisation effects on the annual changes in unemployment as well as the cumulative changes since 2008. Details of the estimates are provided in online supplementary table A1. A graphical summary of the coefficients of this table is provided in Figure 8. To visualise the impact of the various effects, Figure 8 provides *large markers if the effect is at least significant*

Table 2. *Correlation coefficients sector output shares and urbanisation shares.*

	Agri	Food	Lowtech	Mehitec	Finbus	Other	Cities	Commute	Rural
Agri	1								
Food	0.180	1							
Lowtech	0.142	0.087	1						
Mehitec	−0.185	−0.117	0.150	1					
Finbus	−0.381	−0.300	−0.434	−0.174	1				
Other	−0.055	−0.574	−0.129	−0.448	−0.207	1			
Cities	−0.359	−0.095	−0.132	−0.262	0.352	0.123	1		
Commute	−0.341	−0.065	−0.201	0.211	0.242	−0.132	0.044	1	
Rural	0.484	0.111	0.230	0.036	−0.411	0.006	−0.724	−0.721	1

207 EU NUTS 2 regions.

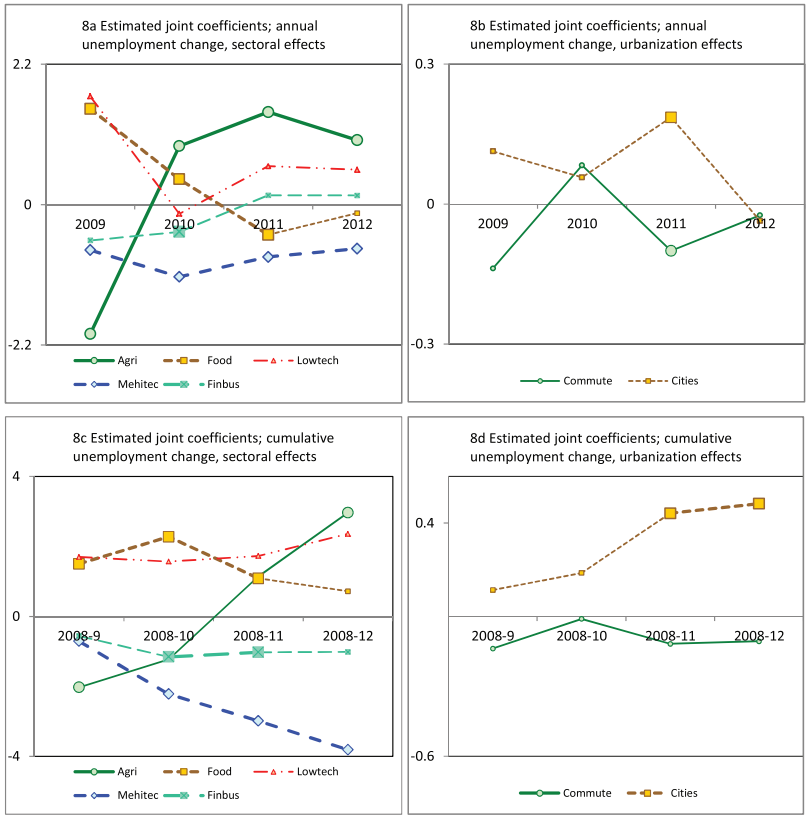

Figure 8. *Sectoral and urbanisation coefficients, joint effects on change in unemployment.*
Notes: Large markers indicate significance at the 10% level; thick lines connect two significant markers; default sector: 'other'; default population type region: 'rural'.

at the 10 % level and small markers otherwise. In addition, Figure 8 *connects two large markers by a thick line* and a thin line otherwise.

Regarding the sectoral influences, we see for annual changes (Figure 8a) a large impact for agriculture, food and mehitec. The initial impact for food is positive, indicating that *un*employment rises faster in food-intensive regions. Similarly, but after a delay of 1 year, the impact for agriculture is positive, indicating that unemployment rises faster in agriculture-intensive regions. In contrast, the impact of mehitec is always negative, indicating that unemployment is lower in mehitec-intensive regions. This is fully in line with our findings in the previous section. When we translate the annual effects to a cumulative experience (Figure 8c), we observe that the high unemployment changes for food-intensive regions disappears after 3 years and that the low unemployment changes for agriculture in the first year switch to high unemployment changes in the fourth year. Most importantly, the low unemployment changes for mehitec-regions become stronger over the years, again this corroborates our findings in the previous section.

Regarding regional urbanisation and compared with our findings in the 2nd section based on the univariate regressions, significant changes occur once we control for the region's sectoral composition. First, we note that for the annual changes (Figure 8b), relative to the rural area benchmark, the share of a region's commuting or city population is no longer significant, with the exception of the year 2011. Second, we note that the impact

of a region's share of commuting population is in line with our findings of the 2nd section, namely lower unemployment changes in 2011, and that, and opposed to the 2nd section, the impact of the regional share of city population is now significant once we control for sectoral composition, with more urbanised regions (higher population share in cities) having a significantly larger upward change in unemployment in 2011 and the cumulative impact for cities is strong enough to last until 2012 (Figure 8d).

All in all, the above discussion leads us to conclude that most of the observed urbanisation impact on unemployment changes that we identified in the 2nd section, can be explained by the sectoral composition of output for the regions once we allow for both urbanisation and specialisation to matter for regional unemployment resilience in the wake of the 2008 crisis. Having said so, we still find that urbanisation, that is to say a region's population distribution across cities, commuting and rural areas matter as well in particular 3–4 years after the onset of the Great Recession. In particular, a larger population share in commuting areas or cities has respectively positive and negative implications for the initial impact of the crisis on unemployment. From a theoretical point of view, it is, of course, hard to disentangle the sector impacts from these urbanisation effects as they represent two sides of the same coin as the spatial concentration of factors of production (urbanisation) affects the sector composition of the region. However, the fact that mehitec sectors, in combination with commuting areas, cope relatively well with the Great Recession suggests that a region's make up in term of its allocation of population across cities, commuting and rural areas might be important or the way a region copes with large shocks.

Urbanisation, sectoral composition and initial impact on GDP

Finally, we briefly look at the relationship between urbanisation, sectors and the change in real GDP per capita and real GDP as an indicator of resilience. The disadvantage of using GDP compared with unemployment as an indicator is that we only have information available up to and including 2010, so for only 2 instead of 4 years. We can therefore only analyse the annual effects for 2008–2009 and 2009–2010 and the cumulative effect for 2008–2010. Still, we think it is important that our assessment of the impact of urbanisation and sectoral composition is not only based on one regional economic 'outcome' variable, in casu unemployment, so we report the GDP results despite the fact that we thus have only 2 'crisis' years. The effects for GDP and GDP per capita are usually quite similar, but there are some deviations nonetheless, so we report both measures. As we explained previously, we lack regional *employment* data for our sample of regions beyond 2008 and this also holds for a possible break down of our data into sectoral employment (instead of output). Still, data at the national level are available and in the online supplementary appendix, see supplementary figure A1; we show that national employment across different sectors is impacted rather differently after the crisis, which is consistent with what we find for regional unemployment (2nd-4th sections above) and GDP (this section).

Online supplementary table A2 reports the individual effects for the univariate regressions of urbanisation on GDP, similar to the 2nd section for unemployment. We note that in 2008–2009 and cumulatively for 2008–2010, the impact of cities on GDP growth is negative, whereas the impact of commuting is positive. This is quite in line with the results we found for unemployment.[8] Online supplementary table A3 reports the individual effects of sectoral composition on GDP, similar to the 3rd section for unemployment. Again, the results are in line with the unemployment results. The annual impact in 2008–2009 for food and lowtech is negative, whereas that for mehitec is positive for GDP per capita and for finbus is positive for GDP.[9]

Most relevant for our present purposes, Table 3 provides the *joint effects* of urbanisation and sectoral composition on GDP, similar to the 4th section for unemployment. In line with our results for unemployment, we find that the initial impact for food and lowtech is negative. The annual (2009 and 2010) results for both sectoral composition and urbanisation do not explain much in terms of the variance in GDP across regions, but when it comes to the cumulative impact, see third column in Table 3, urbanisation matters in the sense that regions with a larger population share in commuting areas coped better in terms of GDP change with the initial impact of the crisis than regions with a larger population share in cities, which is in line with our findings in the 4th section for unemployment. Still, the GDP results should be interpreted with care as we only have 2 years of 'post-2008' observations.

Conclusions

Some regions are more resilient when confronted by economic shocks than others. The literature on regional resilience has been booming in recent years, see for a survey the 2010 special issue of *The Cambridge Journal of Regions, Economy and Society* on *The Resilient Region*. Evidence into the determinants of regional resilience is, however, still rather scarce.

As the relevance for urbanisation as a key determinant for regional growth is well established, we look at the relationship between urbanisation and resilience, where resilience is confined to the initial impact of the crisis for the period 2008–2012. More specifically, we provide systematic evidence how the crisis, also known as the Great Recession, impacted differently on the 255 EU NUTS 2 regions by looking at regional unemployment and GDP differences. We investigate the relevance of two possible determinants of regional resilience for the current crisis and the EU regions: regional urbanisation (as measured by the within-region population distribution across cities, commuting and rural areas) and specialisation (measured by a region's sectoral output composition). The possible relevance of the degree and

Table 3. *GDP and GDP per capita joint effect estimates; probabilities in parentheses.*

	2009	2010	Cumulative 2008–2010
Change in GDP per capita (%); default sector: 'other'; default settlement: 'rural'			
Agri	–0.1210 (0.523)	–0.1456 (0.373)	–0.2881* (0.079)
Food	–0.1521** (0.015)	–0.0708 (0.184)	–0.2213*** (0.000)
Lowtech	–0.3446* (0.097)	0.2494 (0.162)	–0.1454 (0.416)
Mehitec	0.0671 (0.390)	–0.0071 (0.916)	0.0673 (0.317)
Finbus	0.0341 (0.656)	–0.0771 (0.243)	–0.0326 (0.621)
Commute	0.031 (0.205)	0.007 (0.748)	0.037* (0.074)
Cities	–0.067*** (0.008)	0.007 (0.741)	–0.067*** (0.002)
Adjusted R^2	0.0882	0.0001	0.1609
F-test probability	(0.0006)	(0.4301)	(0.0000)
Change in GDP (%); default sector: 'other'; default settlement: 'rural'			
Agri	–0.1745 (0.366)	–0.1889 (0.265)	–0.3958** (0.020)
Food	–0.1676*** (0.008)	–0.1226** (0.028)	–0.2816*** (0.000)
Lowtech	–0.3635* (0.085)	0.2340 (0.207)	–0.1887 (0.305)
Mehitec	0.0228 (0.774)	–0.0745 (0.285)	–0.0435 (0.530)
Finbus	0.0470 (0.546)	–0.0800 (0.243)	–0.0231 (0.734)
Commute	0.030 (0.220)	0.011 (0.604)	0.041* (0.056)
Cities	–0.067*** (0.010)	0.011 (0.617)	–0.063*** (0.005)
Adjusted R^2	0.0899	0.0134	0.1819
F-test probability	(0.0005)	(0.2070)	(0.0000)

Notes: Shaded cells ***, ** and * indicate significance at the 1%, 5% and 10% level, respectively.

composition of urbanisation for resilience is found in the fact that urbanisation also signals the degree to which cities or regions are able to adjust to shocks (see for instance, Fingleton et al., 2012, 2015; Glaeser, 2005 or Martin et al., 2013).

Our main finding is that EU regions with a relatively large share of their population in commuting areas are relatively resilient in the period 2008–2012. By way of data limitations, resilience can only refer to the resistance to the initial impact of the crisis. In contrast, regions with a large share of their people living in cities seem more impacted by the 2008 crisis shock. In addition, sectoral composition matters as well, regions with a larger share of output in medium and high tech industries were less affected in terms of unemployment change in the aftermath of the crisis during the period 2008–2012.[10]

It is beyond the purpose of this paper to disentangle exactly as to why regions with relatively more of its population in commuting areas and less in cities were more resistant to the crisis shock. One obvious route is that people living in commuting areas are relatively more inclined to be employed in sectors, like medium or high tech, that were less impacted by the shock or these workers maybe, in terms of their human capital, more adaptable and/or employed in those jobs that were less prone to be impacted by the shock of the 2008 crisis. This is certainly a topic for further research. Our findings are also consistent with the notion that resilience and (growth) potential of regions in good or bad times is not always or not even foremost simply a matter of trying to be more urbanised. This does not only have important research implications in the sense that we should pay more attention to the role of smaller urban areas and the interplay between these areas and larger cities but it also has policy implications. The current regional policy agenda in the EU is very much dominated by the notion of *smart specialisation*. A region's specialisation is undoubtedly relevant as also our estimations results suggest, but this also holds for the spatial allocation of a region's population. Our findings indicate that more urbanisation per se is not necessarily good for regional growth and resilience.

Supplementary material

Supplementary material is available at *Cambridge Journal of Regions, Economy and Society* online.

Endnotes

[1] We take the *region* as our unit of observation to investigate these determinants. We therefore do not use country fixed effects as this would interfere with the regional determinants to the extent that countries specialise in certain sectors or portray certain urbanisation characteristics. Similarly, using data from Brakman et al. (2009), we are able to incorporate market potential effects. Again, this partially interferes with the sectoral and urbanisation determinants we are focusing on, although to a limited extent only (rarely a change in significance and never a change in significant sign). More importantly, it would restrict our sample to only 163 regions from 12 countries (results are available from the authors upon request).

[2] This connection also relates to the Heckscher–Ohlin trade models applied to smaller spatial scales than countries (see Courant and Deardorf, 1992, 1993). They use the term 'lumpiness' for the uneven distribution of factors of production over space, see Brakman and van Marrewijk (2013) for some empirical support.

[3] The number of regions for which we have information on both urbanisation and unemployment available varies from 254 regions in 2008 to 271 regions in 2012. Further information requirements reduce the number of incorporated regions in the formal analysis to 207, see below.

[4] These are unweighted regional averages. When we weigh by population the share of the population living in cities is 29.9%, the share in commuting zones is 40.9% and the share in rural areas is 29.2%.

[5] This classification into six rather broad sectors is the most detailed information available at the NUTS 2 level.

[6] For the EU regions as a whole, these two sectors represent the highest shares of exports, both about 14% of the total (with the exception, of course, of

'other' exports, which represents about 57% of the total). Unfortunately, reliable data on inter-regional trade flows on the NUTS 2 level do not exist, see Thissen et al. (2013a, 2013b).

[7] One manifestation of regional specialisation are regional trade patterns. Unfortunately, see online supplementary figure A1, there are no inter-regional trade data available for the EU regions in order to assess the impact of trade on regions.

[8] Similarly for GDP growth, with the exception of the cumulative effect for city population.

[9] The latter result contrasts with the finding for unemployment.

[10] For example, it could be the case that employers in these sectors hold on to their workers longer than in other sectors because specialised workers are hard to find.

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