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The geography of the economic crisis in Europe: national macroeconomic conditions, regional structural factors and short-term economic performance

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This article explores the linkages between pre-2008 crisis national macroeconomic conditions, regional resistance factors and depth of the crisis in the regions of the EU27. The results suggest that only a limited set of macroeconomic factors shape the regional reaction to the crisis. A healthy current account surplus is associated with stronger economic performance during the post-2008 recession. Conversely, high public debt countries are more successful in sheltering their regional economies in the short run. When looking at regional-level resistance, human capital is the single most important positive factor. Conversely, research and development-intensive regions are more exposed to negative shocks.

Introduction

The 2008 global economic crisis has been the most severe economic recession since the Great Depression. The pervasiveness and geographical heterogeneity of its impacts have attracted increasing interest in understanding how and why local and regional economies react to economic shocks (see Archibugi and Filippetti, 2011; Brakman et al., 2015; de Beer, 2012; European Commission, 2013; Fingleton et al., 2012; Groot et al., 2011; Hassink, 2010; Kitson et al., 2011; Lagravinese, 2015; Martin,

2010). However, notwithstanding the growing attention devoted to the geography of the 2008 economic recession and to the 'resilience' of regions to such shocks (cf. Agder, 2000; Dawley et al., 2010; Fingleton et al., 2012; Hopkins, 2008; Martin and Sunley, 2014; Martin et al., 2015), cross-country empirical evidence on how pre-crisis conditions shape regional reactions during the recession is still scarce.

The resilience of regions to economic shocks is the result of the combination of two factors: regional shock-resistance and subsequent 'recovery' capabilities (Lagravinese, 2015;

[Martin, 2012](). Current constraints in terms of the availability of data impede any systematic attempt to identify the determinants of the regional socioeconomic outcomes observed in the new 'equilibrium' following the crisis. In addition, the identification of persistent *recovery* patterns would be not only premature but potentially misleading ([Groot et al., 2011]()).

As a result, this article focuses its attention on the link between pre-crisis national and regional *resistance* factors and the short-term regional economic consequences of the recession. In particular, it looks at the extent to which 'healthy' national-level macroeconomic conditions before the crisis can contribute to mitigate the contraction of the regional economy at the early stages of the crisis and tests whether regions can rely on subnational resistance factors to shelter their territories from the short-term consequences of external shocks over and above national-level conditions.

This article innovatively contributes to the existing literature in three ways. First, it combines national and regional factors exploring the linkages between the 'macro' and the 'meso' levels during the crisis. Second, building upon previous contributions (see [Brakman et al., 2015]; [Groot et al., 2011]()), the analysis is focused on a set of key regional structural indicators, for example, the regional industrial mix, human capital and innovation, that can be directly targeted by regional policies, providing practical guidance to policy-makers at all levels. Third, the article extends existing empirical evidence by covering the entire European Union. The sample includes 254 NUTS2 regions from all EU27 countries for which data are currently available.

The first part of the article provides systematic descriptive evidence on the degree of sensitivity to the recessionary shock of the regional economies of the entire EU, focusing on regional indicators of wealth, labour markets and regional imbalances before and after the crisis. Special attention is devoted to explore the trends that occurred between 2008 and the latest available year, as well as the pre-crisis conditions upon which such changes have occurred. The article subsequently assesses the links between post-2008 regional economic performance (period 2008–2010) and indicators accounting for national macroeconomic conditions as well as regional 'resistance' conditions measured before the crisis (period 2004–2007).

The empirical results suggest that while pre-crisis regional development trajectories are highly heterogeneous both in terms of economic growth and employment dynamics, after the crisis a marked centre-periphery spatial pattern emerges. While within-country regional imbalances have shrunk in most countries, regional disparities across the EU as a whole have increased both in terms of Gross Domestic Product (GDP) and unemployment. The results suggest that only a limited set of macroeconomic factors shape the regional reaction to the crisis. A healthy current account surplus is associated with stronger economic performance and better regional employment during the early stages of the post-2008 recession. Conversely, high public debt countries are more successful in sheltering their regional economies in the short run. When looking at regional-level resistance, human capital is the single most important positive factor. On the contrary, research and development intensive regions are more exposed to negative shocks, at least in the short run. When it comes to short-run changes in regional employment, the role of sectorial patterns prevails. Regions with larger shares of agriculture and construction sectors suffer more in terms of employment loss. In addition, the results unveil a significant divide between the regions of the 'old' Europe and the new member states.

The crisis and its regional consequences

The recession technically started in the first quarter of 2008 (i.e. in the second consecutive trimester of economic negative growth) and

lasted until the last quarter of 2009. Between the second half of 2010 and 2011, the EU recorded a second wave of negative economic growth figures (Eurostat, 2014). Whereas the crisis has impacted on the majority of European countries, its depth has been highly unequal across the Continent and its long-term impacts are likely to be similarly uneven. As argued by earlier policy reports and academic papers, the proper understanding of the recession impacts upon which to modulate future regional policies calls for a perspective able to take into account the different geographies and intensities of the social, economic and territorial dynamics triggered by the downturn (European Commission, 2013; Martin, 2010). The crisis is, in most Member States (MSs), a private debt crisis that turned into a sovereign debt crisis (Milio et al., 2014). These two different, yet intertwined, phases of the crisis have followed successive paths, with the outbreak of the private debt crisis in 2008 and the subsequent uprising of the sovereign debt crisis in 2010.

In the first phase of the crisis (private debt crisis), private debt was accumulated in current account deficits and in mortgage credit, the latter fuelling house-price inflation and the costs of living, with an effect on wage demands. The construction boom, increasing rates of home ownership and rising earnings, in particular for employees in the financial sector, came to an abrupt end in 2008. Regions that were flourishing before the crisis were then hit in more than one respect: relatively well-paid work in construction-related sectors disappeared, middle class households were left in negative equity, and white collar workers lost their jobs. To the extent that migrant workers or second-home owners from other EU countries were affected by the housing market crash, there was some cross-border risk-sharing. The explosion of the housing bubble and its repercussions on the overheated financial market and on the real economy proved especially detrimental for the better-off regions.

In the second phase (sovereign debt crisis), the stabilisation function played by automatic stabilizers vis-à-vis the economic and social effects of the private debt crisis has been weakened by the effects of austerity measures implemented as a response to the sovereign debt crisis. Compared to past crisis experiences, social expenditure reacted in the first year of this crisis slightly more strongly to the economic cycle than in the past. The year after the start of the crisis, the developing trend of social expenditure seemed to broadly follow past trends with an improvement in the output gap and a reduction in the deviation of social expenditure. However, two years after the beginning of the crisis, the adjustment of social expenditure relative to its trend slowed down pro-cyclically with a constant or even accelerating pace. This diverged from trends in past recessions, where a deterioration in the output gap was usually accompanied by an upwards deviation of social protection expenditure from its trend (Bontout and Terezie, 2013).

The crisis hit the EU territories during a phase of progressive regional convergence. Between 2000 and 2008, regional disparities in GDP per head were shrinking, largely due to the positive dynamics of the regions in the new MSs of the Union. In 2009, this convergence trend came to a halt and then reverted towards divergence in 2010 and 2011. Increasing regional disparities during the crisis cannot be fully explained by the generalized contraction of the economies of the MSs. Indeed, even in the MSs most severely impacted by the crisis, remarkable differences have emerged at the regional level. The case of Italy is representative in this regard. Whilst the regions in the North suffered stronger short-term impacts of the crisis on their GDP levels due to their higher degree of international integration, the regions of the Italian Mezzogiorno—sheltered by employment in the public sector and limited international interconnections—experienced milder short-run impacts but stronger and more durable effects in their medium-to-long run trajectories. These

differences in the responsiveness to the crisis of the regions of the same country reflect the fundamental heterogeneity in the capabilities of the various territories to respond to economic shocks and absorb their consequences.

Across the EU territory, the impact of the crisis led to a 4.5% decline in real GDP per capita in 2009 (Eurostat, 2014), bringing to an end a decade of economic growth. Maps in Figure 1 show regional changes in GDP per capita during the crisis. They also offer a snapshot of interregional disparities for the most recent available year (2010). The first map (post-2008 performance) shows marked differences across countries in the ways the crisis impacted regional economies in the short-term. The map shows that Polish regions recorded the most positive performance during the crisis. In addition there are also marked differences in short-term subnational economic performance trends during the crisis. For a group of MSs that includes Poland, the Czech Republic, Slovakia, Italy, Denmark, Spain, Latvia, Hungary, Sweden and Slovenia, local economies from the same country reacted in a homogenous fashion

(either mostly positive or mostly negative). In the remaining countries, by contrast, regional economies show greater sub-national variations. This is, for example, the case in the United Kingdom and France: both countries have regions with very positive—respectively North-West England and North-Eastern Scotland and Ile-de-France and Provence-Alpes-Cote d'Azur—as well as negative economic performance—Yorkshire, the Midlands, and the regions of Bourgogne, Champagne-Ardenne, Bretagne and Pays-de-la-Loire, respectively.

Figure 2 shows pre-crisis average regional levels of unemployment (2004–2007), as well as their evolution during the crisis (2008–2012). Unemployment in the EU rose from an average of 7.1% in 2008 to 9.7% in 2010 and 10.5% in 2012 (Eurostat, 2014).

Comparing the first and second map in Figure 2 shows very significant differences emerged across the EU regions. There is no clear North-South divide: unemployment data suggest that reductions/increases in unemployment rates followed more complex patterns. Regions in both the Northern and the Southern
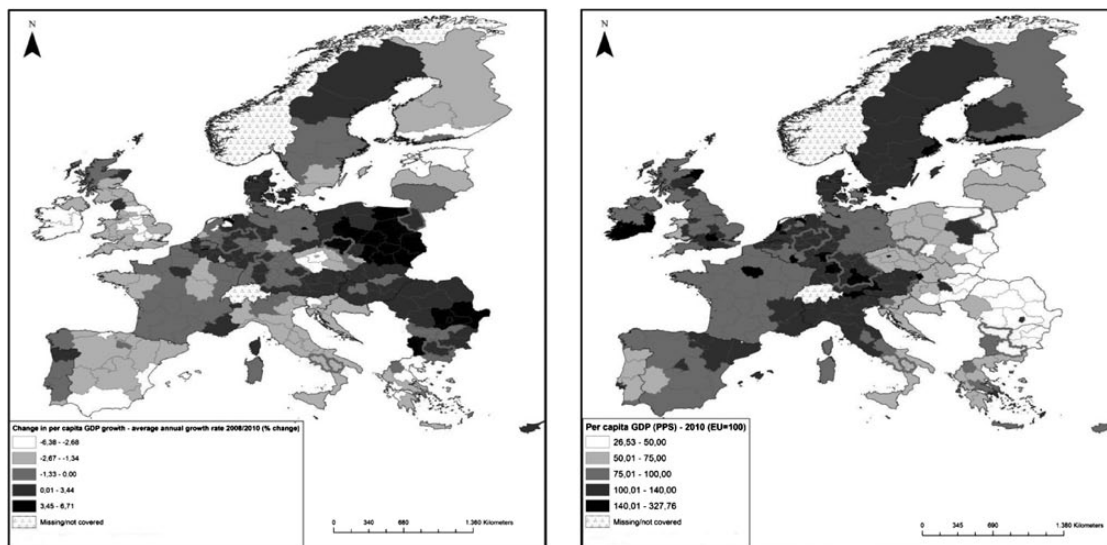

Figure 1. *Average annual growth rates of regional GDP per capita during 2008–2010 (left), and per-capita GDP in 2010 (right), EU=100.*
Source: Own elaboration on Eurostat data.

EU countries—namely Spain, Ireland, Greece and the Baltic Countries—were among the most severely hit during the crisis, with average annual increases in unemployment rates higher than 2.4%. The regions of Croatia, Denmark, Slovenia, Cyprus, Italy (Campania and Calabria in particular) and Severoiztochen and Yuzhen Tsentralen in Bulgaria also show relevant increases.[1] At the other end of the spectrum, all German regions and part of the Polish, Austrian, Finnish and Belgian regions experienced a decrease in total unemployment. Between these two opposed groups lie all other regions. Overall, again, the picture is one of a continental European area centred on Germany and Poland which experienced a reduction in unemployment, and an overall ring of more peripheral countries (Spain, Ireland, Denmark, the Baltic Republics, Cyprus and Greece) where unemployment rose quite remarkably.

These trends impacted on very different initial levels of fragility (first map in Figure 2). The most striking case is Italy, where a relatively homogeneous variation during the crisis hit *a priori* highly heterogeneous regions: unemployment rates before the crisis were in four out of the five Southern regions as much as three times higher than in the most prosperous parts of the North.

The interaction between pre-crisis conditions and subsequent recessionary trends can be explored by analysing the dispersion of unemployment rates. It is operationalized through the within-country coefficient of variation: the higher the value of this index the wider the differences across regions. Figure 3 shows the pre- and post-crisis indices for each MS for which data is available, as well as for the EU as a whole. Countries are then ranked according to the difference between the first and second period. The graph suggests that—apart from Portugal, Bulgaria, Belgium, Finland and Romania—the majority of the EU countries experienced a reduction in the regional dispersion of unemployment. In other words, they experienced a trend of national convergence towards more similar unemployment levels. Again, this may suggest that, at least during the 2008–2012 period, the crisis had an equalising effect within countries and hit regions
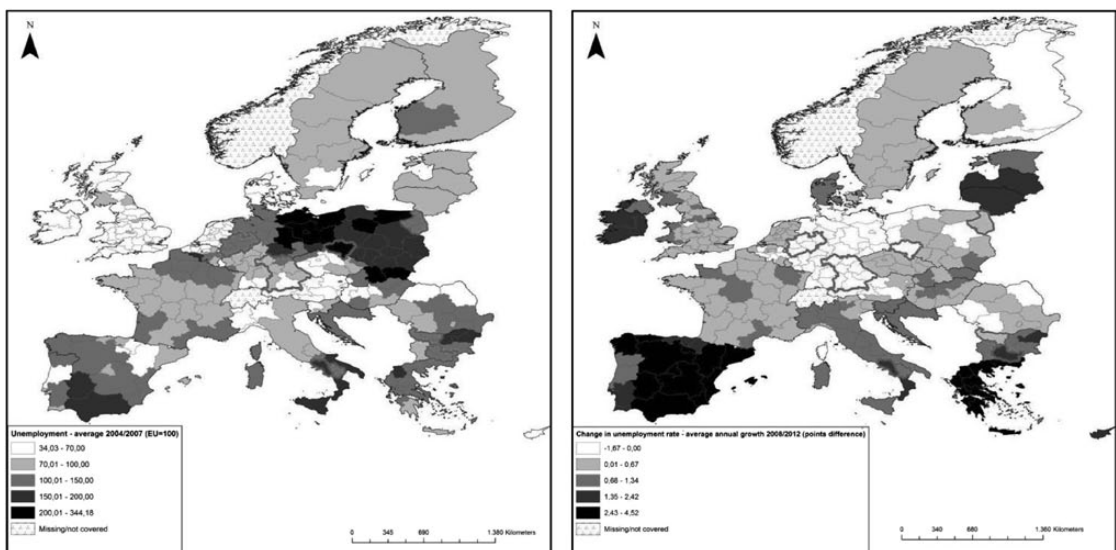

Figure 2. *Average regional unemployment rate during 2004–2007 (left), and average annual variation of unemployment rates during 2008–2012 (right).*
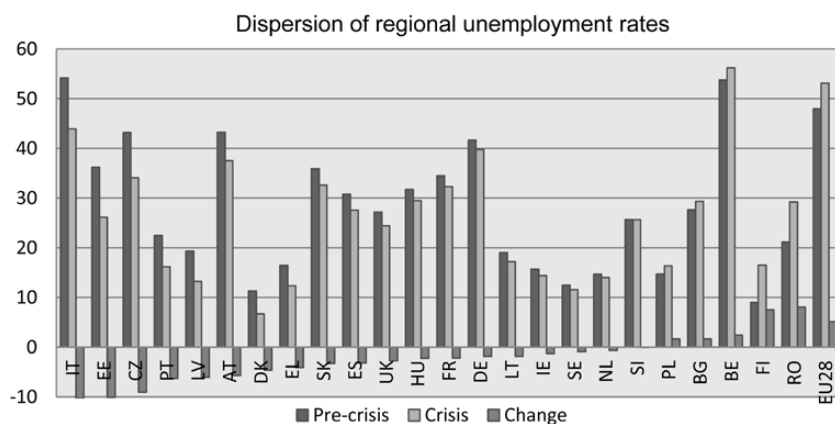*Source:* Own elaboration on Eurostat data.

Figure 3. *Coefficient of variation for NUTS 2 level unemployment rates before (2004–2007) and after (2008–2012) the outbreak of the crisis.*
Source: Own calculations on data from Eurostat. Not available for Croatia, Cyprus, Luxembourg and Malta. For states with only one or two NUTS2 regions, NUTS3 level dispersion was used.

with initially lower levels of unemployment more harshly. Such a result confirms earlier analyses carried out by the European Commission and underlines a process of intra-national convergence driven by the exacerbation of overall unemployment (Bubbico and Dijksrtra, 2011). Yet, while there has been a process of intranational convergence across most regions, some regions experienced positive trends of unemployment reduction and economic growth: the index for the EU as a whole increased, meaning that there has been a process of divergence across Europe. Such a trend may create tensions across the Union among countries where the crisis has been felt more/less profoundly.

Regional resistance: why do regions differ in their short-term reaction to economic shocks?

An extensive literature has tried to explain the reasons behind economic shocks, as well as to support the design of policies able to mitigate their effects (Martin et al., 2015). While most of the literature has been macroeconomic in nature, following the start of the 2008 recession an increasing number of studies have tried

to understand—and explain—the local and regional heterogeneity of the crisis' effects.

In this context, various studies have relied on the concept of 'regional resilience' as an explicative variable for the heterogeneous consequences of economic shocks. Although a lively debate on its conceptualization makes it difficult to develop an univocal definition (see Dawley et al., 2010; Fingleton et al., 2012; Martin and Sunley, 2014), resilience is broadly described as 'the capacity of a system to absorb disturbance and reorganize while undergoing change, so as to still retain essentially the same function, structure and feedbacks' (Hopkins, 2008: 54). Martin (2012) in particular identifies four main dimensions of resilience (cf. Figure 4): (a) *Resistance*, which refers to how sensitive regional output and employment are to a shock—this will, in turn, determine the strength of demand for public intervention generally and for cohesion policy in particular; (b) *Recovery*, that is, how fast and comprehensively the region bounces back from a negative shock like the financial crisis since 2008—this will determine how long there will be exceptional pressure on public policies; (c) *Re-orientation*, which concerns the extent to which a regional economy changes after a

shock—which constitutes a long-term need for public intervention if it is feared that the structural reorientation leads to a low level equilibrium; and (d) *Renewal*, that is the extent to which regional economies 'renew' their growth paths.

Given the data currently available to cover the regions of the entire European Union it would be impossible to operationalize and empirically assess regional resilience in all its dimensions. Therefore—while it is important to correctly situate our analysis in the broader debate on regional resilience—we focus our attention on regional resistance only.

Various factors have been linked to the regional capabilities to resist recessionary shocks. Martin and Sunley (2014), in particular, identify three main sets of factors: contextual, compositional, and collective factors. Contextual factors refer to the way in which local and regional agents are situated within broader and multi-scale institutions, national policies, and even international networks and the global division of labour. Compositional factors make reference to the sectorial/industrial structure of local and regional economies. Collective factors include the characteristics and relationships between local economic agents within each regional economy.

Building upon this conceptualization, we identify three main sets of pre-crisis conditions

Figure 4. *Regional resistance in a broader perspective.* *Source:* Adapted from Martin (2010).

which may shape regions' resistance to shocks: Macroeconomic and financial crisis transmission factors, Regional industry-mix and regional human capital and innovation conditions. The conceptual framework for the analysis is summarized in the chart in Figure 5.

The first set of factors relates to macroeconomic factors. These are macronational conditions/imbalances driving the transmission of the crisis from the international context into the national and regional economies (working at the 'contextual' factors conceptualized by Martin and Sunley 2014). They are linked to the degree of global financial and trade integration, as well as to national fiscal policy and public budget imbalances (potentially explaining subsequent fiscal austerity and debt crisis). Analysing the link between the cross-country incidence of the 2008 recession and pre-crisis factors, Lane and Milesi-Ferretti (2010) show how macroeconomic factors (such as current account deficits and openness to trade) are helpful in predicting the intensity of the crisis. In spite of the processes of rescaling of nation-state powers in favour of both sub-national and supra-national units (Brenner, 2004) that occurred during the last decades, regions are still influenced almost ubiquitously by national/state-level policies and conditions. Macroeconomic factors hence provide us with a partial explanation for the depth of the crisis in various countries and its 'triggers' and/or 'multiplier' factors to regions. Furthermore, it is within regional, urban and local economies that international economic shocks work out their effects (Martin and Sunley, 2014).

Second, the economic literature has identified numerous quantitative features of regional economies that shape their ability to resist and adapt to shocks and change (Crescenzi, 2009; Crescenzi and Rodríguez-Pose, 2011). In particular, two key subdimensions are relevant with reference to regional resistance: the regional industrial mix, and a group of regional competitiveness/innovation factors. The regional
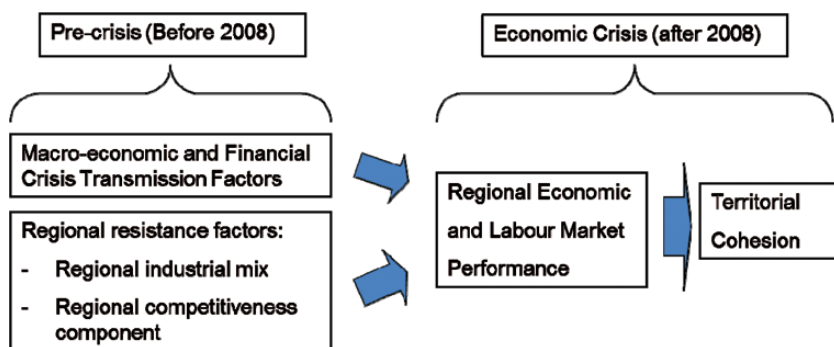
Figure 5. *Operational framework.*
Source: Own elaboration.

industrial mix, i.e. the sectorial structure of the regional economy, is a key factor determining regional crisis resistance. 'Conventionally, […] manufacturing and construction industries have been viewed as being more cyclically sensitive than private service industries, and the latter more sensitive than public sector services, which are often assumed to be largely immune to economic recessions' (Martin, 2012: 13). Regional sensitivity is the result of the combination of these sectorial sensitivities 'weighted' by the shares of these sectors in the regional economy, influencing the adjustment of the regional economy, its output and employment to cyclical shocks.

The industry mix can also influence regional resistance as a result of the different extent to which they can rely on various shock absorbers. For example, public employment protection mechanisms may prevent a contraction in output from translating into a proportional decline in employment in the regions where a larger share of employment is concentrated in the public sector. More stringent employment protection regulations and less flexible labour markets may shelter the regional economy from temporary shocks: stable employment levels stabilize local demand, with productivity absorbing the shock (Groot et al., 2011: 447–449).

In addition, the diversity of the regional economy in terms of sectorial specialization and typologies of economic activities enhances resistance: different sectors exhibit different degrees of sensitivity to macro-economic shocks (e.g. interest rate shocks or restrictions of the credit market) and more diversification reduces the concentration of risks. However, the beneficial effects of risk diversification can be counteracted by sectorial interconnections that increase the transmission of shocks from one particular sector to all others (Martin, 2012: 12). Hence, the effect of a diversified economic structure on resistance is ambiguous.

A second subset of regional factors likely to shape the ability to react to external shocks relates to the determinants of regional competitiveness. In our analysis, we focus in particular on two main factors: human capital and skills and innovation efforts. The accumulation of human capital and the allocation of (public and/or private) resources to R&D activities are long-term structural characteristics of the regional economy that adjust slowly over time and shape local growth trajectories through two key channels.

First, both regional human capital and innovation efforts are crucially linked with the capability of the local economy not only to generate new knowledge but also to absorb externally generated new ideas and cognitions (Crescenzi, 2009; Crescenzi and Rodríguez-Pose, 2011). The absorption and generation of new knowledge and its translation into new products and

processes are key drivers of regional economic performance and competitiveness in all phases of the economic cycle. However, the capability to innovate can prove particularly important during a recession in order to quickly adjust to adverse external conditions at the macronational and 'global' level. In this context, an innovation-prone regional environment can mitigate the adverse impacts of a crisis not necessarily relying on technological forms of product innovation but, on the contrary, by leveraging process (e.g. reducing production costs to maintain competitiveness in a context of decreasing demand) or organizational innovation.

Second, the innovativeness and human capital intensity of the regional economy also have a significant impact on the regional connectivity with the national and global economy, influencing the quantity and typology of external investments localized in the area. Regions investing more in both innovation and human capital attract the most sophisticated and high-value-added functions of Multinational Firms, anchoring the regional economy in most advanced stages of Global Value Chains (Crescenzi et al., 2014). Sophisticated knowledge-intensive functions of large multilocalized firms are less likely to be adversely affected by economic crisis and may act as stabilizers for the local economy, increasing its resistance to adverse economic shocks.

In other words, regional human capital and innovation efforts can simultaneously capture the internal capabilities to 'innovatively' react to adverse external conditions and the regional embeddedness into more valuable (and possibly more resilient) external networks. Therefore, both these structural characteristics of the regions can play a key role as regional resistance factors, shaping the regional capability to react and adjust to the crisis.

Methodology and data

It is crucial to bear in mind that our research makes no claim to offer any causal interpretation of the determinants of national and regional impacts of the economic and financial crisis. There is consensus in the existing academic literature that, given the current constraints in terms of data availability (in particular at the regional level), any such attempt would be not only premature but potentially misleading (Groot et al., 2011; Martin, 2012). Conversely, in line with the existing literature, our article presents a systematic analysis of a number of key quantitative stylised facts on the links between the economic and financial crisis and both regional economic performance and broader structural conditions.

As stressed by Martin and Sunley (2014), there is no consensus in the literature on the best approach to the quantitative operationalization of the regional resistance to economic shocks. The empirical analysis presented here follows Lane and Milesi-Ferretti (2010) and Groot et al. (2011) and is based on the regression of post-2008 regional performance indicators on a sets of pre-crisis transmission and resistance factors at the national and regional level. We do not include any regressors based on the post-2008 period, as our goal is rather to identify national and regional 'initial conditions' that correlate with regional dynamics during the crisis period. The empirical model takes the following form:

$$\Delta Y_{i,c,t} = \alpha + \beta_0 Y_{i,c,t-1} + \beta_1 T_{c,t-1} + \beta_2 R_{i,c,t-1} + \varepsilon_{i,t} \qquad (1)$$

where $Y_{i,c,t}$ is the average annual growth rate of per-capita regional Gross Value Added (GVA) in region i belonging to country c, during the crisis period 2008–2010 (t). Equation (1) will also be estimated with Regional Employment as dependent variable (replacing GVA); $Y_{i,c,t-1}$ is the average per capita regional GVA during 2004–2007 ($t - 1$), included to control for Solow-style convergence of per-capita income[2]; $T_{c,t-1}$ is a vector of national macroeconomic transmission factors; $R_{i,c,t-1}$ is a vector of regional resistance factors; $\varepsilon_{i,t}$ is the error term.

The vector T captures the international context of the crisis. The mortgage crisis in the USA quickly expanded across countries due to the high level of trade and financial integration (Rose and Spiegel, 2010). Following Rose and Spiegel (2010), who suggest that trade linkages were more relevant than financial ones, we particularly focus our attention on the former. The vector therefore includes:

Current account balance

It is one of the key measures of a country's foreign trade and financial transfers. It consists of the balance of trade, plus the net factor income and net cash transfers. A current account surplus indicates a country having more net foreign assets than liabilities. Yet we prefer to proxy trade links via current account balance, rather than only trade balance, due to the more comprehensive nature of the selected indicator. In doing so, we follow Groot et al. (2011). Data not presented here shows that the levels of current account balance and of trade balance (exports–imports as a share of GDP) are in our data highly correlated (correlation coefficient of 0.8, statistically significant at the 95% confidence level).

Share of exports to emerging markets on total exports

While more advanced economies in general experienced significant crisis impacts, many emerging markets (particularly in Asia and Africa) suffered significantly less from the downturn. It is hence plausible that trade linkages to areas less affected by the crisis may have helped in maintaining higher foreign demand levels.

FDI net balance

This variable is calculated as the difference between outward and inward Foreign Direct Investment (FDI) stocks as a share of GDP: a negative net balance indicates countries that are net receivers of FDI.

Level of public debt as a share of national GDP

This variable accounts for the fiscal austerity and debt crisis triggered across the Union following the 2008 financial downturn. High-debt countries before the crisis are more likely to suffer the consequences of austerity measures during the crisis.

The vector R of regional resistance factors includes:

Specialization in agriculture, manufacturing and energy and market services

The economic literature suggests that the regional sectorial composition is the result of complex interactions between demand and supply factors, comparative advantage and related specialization patterns (Groot et al., 2011). Sectors more likely to be affected by the economic cycle—such as manufacturing and construction—experienced on average more adverse impacts than others, both in terms of output and unemployment. It is therefore expected that the pre-crisis sectorial composition will offer potential insights on regional economic performance after 2008. The variables are constructed as the share of each sector on the total regional GVA.

Human capital with university education attainments

In the last 20 years, the regional science literature has paid increasing attention to the 'soft aspects' of regional economic performance, namely human capital stocks and innovation efforts, which are more and more seen as key elements in moulding long-term regional socioeconomic performance. The variable is constructed as the percentage of adult population aged 25–64 with tertiary education.

Innovation capacity

The variable is constructed as the total percapita intramural R&D expenditure (GERD).[3]

Finally, the empirical model also includes a dummy for countries which were part of the EU15. We also include a dummy for the 16 countries which were part of the Eurozone at the time of the crisis (including also Slovakia, which entered in January 2009), to control for the fact that countries with pegged exchange rate regimes may have been more vulnerable to the economic shock than countries with more exchange rate flexibility.

The dataset includes all EU regions for which data on our variables of interest are available. The sample includes a panel of 254 out of the 270 NUTS2 regions (following the NUTS2010 classification). The sample hence covers all EU27 Member States' regions except: Germany's Oberpfalz, Niederbayern, Chemnitz and Leipzig; Finland's Helsinki-Uusimaa and Etelä-Suomi; France's overseas territories (Guadalupe, Martinique, Guyane, Réunion); Italy's Emilia-Romagna and Marche; Portugal's Madeira and Azores Islands; UK's Cheshire and Merseyside. A detailed description of variables and their key summary statistics are provided in Appendices I and II, respectively.

Empirical results

Empirically, we estimate equation (1) adopting a robust OLS estimator, with errors clustered at the NUTS2 level. Table 1 presents the main results. Column 1 shows the association between the dependent variable and the national macroeconomic crisis transmission factors, while columns 2 and 3 focus on regional resistance factors. Columns 4 and 5 progressively include the EU15 and the Eurozone dummies. The explanatory power of the regressions is in line with similar studies given the exclusive reliance on pre-crisis regressors, with adjusted R^2 close to 0.45 in the full specification.

Across all specifications, the lagged value of regional per-capita GVA shows the expected negative sign, suggesting the existence of a marginal convergence trend. In line with our theoretical expectations, the coefficients show a positive and statistically significant relation between post-2008 economic performance and the level of pre-crisis current account balance. In other words, regions in countries experiencing a current account surplus (deficit) before 2008 experienced, on average, better (worse) economic performance during the recession. The crisis, in particular, is likely to have made it more difficult to finance large current account deficits, favouring regions in surplus countries. For example, a current account balance surplus of 1% before the crisis is *ceteris paribus* correlated to a positive average annual GVA growth rate after 2008 of nearly 0.3%. This result is robust across all specifications. The link between the international strength of the national economy and the economic consequences of the crisis is further explored by analysing the share of exports to emerging economies (i.e. non-EU, non-advanced economies) on total exports. The share of exports to emerging markets is negatively correlated to post-2008 economic performance. Such result is likely driven by countries such as Greece, Latvia, Finland, the UK, Italy, Lithuania and Ireland, which have a high share of export to such markets (all above one standard deviation over the mean) and yet experienced significant negative impacts during the recession. Once the EU15 dummy is included (models 4 and 5), the emerging markets variable's coefficient loses statistical significance, suggesting that this factor might reflect the differential orientation of international trade patterns in 'old' and 'new' member states.

The coefficient for FDI net balance is negative across all specifications, and turns insignificant after the inclusion of the EU15 dummy in models 4 and 5. The negative coefficient implies that regions in countries which were net receivers of FDI before the crisis experienced, on average, better economic performance after 2008. With the exception of Germany, almost all the countries with a net FDI balance more positive than the EU28

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Table 1. *Per capita regional GVA's average annual growth rate during 2008–2010 and pre-crisis (2004–2007) conditions.*

	(1)	(2)	(3)	(4)	(5)
Lagged GVA	−8.05e−05**	−0.000106**	−0.000109**	−4.31e−05	−2.92e−05
	(3.97e−05)	(4.44e−05)	(4.75e−05)	(4.05e−05)	(4.30e−05)
Current account balance	0.334***	0.311***	0.321***	0.337***	0.324***
	(0.0475)	(0.0707)	(0.0665)	(0.0628)	(0.0618)
Trade with emerging markets	−0.0693**	−0.0643**	−0.0675**	−0.0557	−0.0474
	(0.0305)	(0.0313)	(0.0307)	(0.0338)	(0.0357)
FDI net balance	−0.0457***	−0.0465***	−0.0506***	−0.0154	−0.0116
	(0.0116)	(0.0126)	(0.0119)	(0.0153)	(0.0165)
Public debt	0.000373	−0.00363	0.00434	0.0249***	0.0217**
	(0.00580)	(0.00602)	(0.00717)	(0.00913)	(0.00993)
Share of agriculture		−0.142*	−0.114*	−0.116*	−0.122*
		(0.0721)	(0.0653)	(0.0642)	(0.0653)
Share of manufacturing		−0.0413	−0.0248	−0.0297	−0.0349
		(0.0260)	(0.0263)	(0.0241)	(0.0254)
Share of construction		−0.178**	−0.203**	0.00301	−0.0213
		(0.0903)	(0.0890)	(0.102)	(0.103)
Share of market services		−0.0380	−0.0322	−0.0474	−0.0693
		(0.0445)	(0.0441)	(0.0383)	(0.0455)
Human capital			0.0722***	0.0799***	0.0832***
			(0.0241)	(0.0247)	(0.0243)
Innovation efforts			−0.00104**	−0.00106***	−0.00106***
			(0.000483)	(0.000409)	(0.000404)
EU15				−4.197***	−4.792***
				(1.351)	(1.571)
Eurozone					0.567
					(0.493)
Constant	2.613**	6.648***	4.595**	4.311**	4.858**
	(1.014)	(2.158)	(2.190)	(1.920)	(2.091)
Observations	254	254	254	254	254
Adjusted R^2	0.356	0.378	0.395	0.443	0.445

Robust standard errors in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

average before 2008 have also experienced more severe GDP contractions during the crisis (Netherlands, the UK, Denmark, Ireland, Finland, France and Italy). By contrast, countries such as Malta, Bulgaria, Slovakia, Czech Republic and Poland were both net receivers of FDI inflows and experienced the best economic performance during the crisis. As a matter of fact, when the EU15 dummy is included (model 4 and 5), the FDI variable's coefficient loses significance.

The last macroeconomic variable refers to the weight of public debt: the coefficient is statistically insignificant in models 1, 2 and 3, turning positive and significant when the EU15 dummy is included. In line with Groot et al. (2011) this result suggests that regions belonging to countries with a higher initial government debt on average did not experience worse economic performance. Although the analysis does not claim any conclusions about the direction of causality, results should be taken as a reminder that low levels of public debt *per se* are not a prerequisite for better economic performance at the regional level.

The analysis of regional resistance factors suggests that sectorial patterns are not key predictors for regional economic performance

during the crisis: the shares of agriculture, manufacturing, construction and market services in total regional product show a limited explanatory power. Regions with a higher relevance of agriculture in the regional economy before the crisis seem to have experienced worse output performance during 2008–2010. Such a result is significant across all specifications, yet only at the 10% level. Second, the importance of the construction sector before the crisis is significantly correlated to worse post-2008 performance. This is not surprising given the significant and notorious housing bubble depth in the regions of countries such as Ireland and Spain. However, once the EU15 dummy is included, the coefficient for the weight of the construction turns insignificant. By contrast, the coefficients of the manufacturing and the market services sectors are insignificant across all specifications.

The 'soft aspects' of regional resistance—tertiary educational attainments and innovation efforts—are highly significant across all models and show opposite signs. Regional human capital is positively and significantly associated to economic performance during the crisis. Conversely, R&D intensity is negatively linked to short-term economic performance. The existing evidence on long term growth and innovation dynamics of the EU regions (Crescenzi and Rodríguez-Pose, 2011; Rodríguez-Pose and Crescenzi, 2008) has shown that local R&D investments have a weak association with regional innovation and growth, while human capital is a stronger predictor of long term regional growth and innovation. Such contrast is magnified when looking at short-term cyclical reactions to the economic crisis: human capital is key also to short-term resistance, while regions with high investments in R&D are not necessarily in the best position to face the crisis. In the EU, it is possible to identify several cases of 'cathedrals in the desert' where large (often publicly funded) research infrastructure remains completely disconnected from the needs of the local economic environment.

This research infrastructure is unable to provide regional actors with short-term solutions to regain competitiveness during the crisis. It is the endowment of human capital that can provide the flexibility and the creativity to react to the negative shocks. Therefore, what seems to be key to regional resistance is not technology-driven innovation (captured by formalized R&D investments), but rather a generally innovation-prone environment (captured by the abundance of human capital) that can facilitate process and organizational innovation that, in turn, can make it possible to identify—at least in the short run—creative solutions to external shocks.

As expected, the coefficient for the EU15 dummy is negative and highly statistically significant: regions in the 'old' members of the EU suffered significantly more than those in the 'new' member states. The dummy for the Eurozone, by contrast, is insignificant.

Table 2 presents the results obtained looking at regional employment as dependent variable instead of economic output. The magnitude and signs of most variables remains qualitatively similar to the GVA regressions. The macronational factors that shape short-term economic performance seem to be the same influencing short-term changes in regional employment. What differs is the relative importance of regional resistance factors. Changes in employment are much more sensitive to the sectorial structure of the regional economy. Regions dominated by a larger agricultural and construction sectors suffered stronger contractions in their employment levels. Conversely, both human capital and R&D intensity are not significant predictors of short-term changes in regional employment. While the ambiguity of the link between innovation efforts and employment is in line with the existing evidence on long-term dynamics (innovation might lead to the adoption of labour-saving technologies), the non-significance of the human capital indicator suggests that stronger regional

Table 2. *Regional employment's average annual growth rate during 2008–2010 and pre−crisis (2004–2007) conditions.*

	(1)	(2)	(3)	(4)	(5)
Lagged GVA	−2.54e−06	−1.99e−05	−2.19e−05	2.72e−05*	2.08e−05
	(1.57e−05)	(1.73e−05)	(2.01e−05)	(1.46e−05)	(1.53e−05)
Current account balance	0.156***	0.103***	0.101***	0.113***	0.119***
	(0.0286)	(0.0335)	(0.0343)	(0.0341)	(0.0352)
Trade to new markets	−0.0245	−0.0339*	−0.0331*	−0.0243	−0.0281
	(0.0198)	(0.0192)	(0.0191)	(0.0185)	(0.0191)
FDI net balance	−0.00932	−0.00398	−0.00305	0.0233**	0.0216*
	(0.00728)	(0.00743)	(0.00758)	(0.0115)	(0.0116)
Public debt	0.0119***	0.00770**	0.00632	0.0217***	0.0232***
	(0.00322)	(0.00359)	(0.00395)	(0.00513)	(0.00526)
Share of agriculture		−0.0778**	−0.0825**	−0.0838***	−0.0807**
		(0.0356)	(0.0357)	(0.0322)	(0.0330)
Share of manufacturing		−0.0422***	−0.0464***	−0.0501***	−0.0477***
		(0.0111)	(0.0120)	(0.0108)	(0.0107)
Share of construction		−0.260***	−0.254***	−0.100*	−0.0887
		(0.0550)	(0.0552)	(0.0554)	(0.0552)
Share of market services		−0.0362**	−0.0400**	−0.0514***	−0.0412*
		(0.0178)	(0.0195)	(0.0198)	(0.0212)
Human capital			−0.0135	−0.00772	−0.00922
			(0.0145)	(0.0156)	(0.0155)
Innovation efforts			0.000335	0.000319	0.000318
			(0.000282)	(0.000241)	(0.000243)
EU15				−3.144***	−2.868***
				(0.676)	(0.720)
Eurozone					−0.263
					(0.218)
Constant	−0.314	4.156***	4.603***	4.390***	4.137***
	(0.572)	(1.116)	(1.214)	(1.039)	(1.050)
Observations	254	254	254	254	254
Adjusted R^2	0.271	0.367	0.366	0.456	0.457

Robust standard errors in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

endowments in terms of skills might still be unable to prevent job losses in the weakest segments of the labour market.

One issue common to cross-regional research is that regional variables' coefficients may not capture 'truly regional' variation but simply reflect national institutional differences.[4] We hence run a series of robustness tests on Table 1's regional results. To this aim, we first drop the six countries composed of just one NUTS2 region (i.e. Cyprus, Estonia, Lithuania, Luxembourg, Latvia and Malta), reducing our sample to 248 regions. We then demean both the dependent variable and the regional regressors, by subtracting national averages from regional values. As a result, both the dependent and the regional explanatory variables are now expressed as deviation from their national average.

Results are presented in Table 3. Interestingly, none of the sectoral composition variables appear statistically significant. Coefficients of both Human capital and Innovation efforts retain their significance, while also experiencing a modest increase in magnitude.

Finally, levels of tertiary education differ systematically across European labour markets, with some countries giving comparatively more importance to 'vocational education' than university attainments. We hence add a further

Table 3. *Per capita regional GVA's average annual growth rate during 2008–2010 and pre–crisis (2004–2007) conditions, demeaning regional variables.*

	(1)	(2)	(3)	(4)	(5)	(6)
Lagged GVA	2.50e−05	2.39e−05	3.47e−05	3.80e−05	4.86e−05*	1.10e−05
	(2.06e−05)	(1.91e−05)	(2.37e−05)	(2.52e−05)	(2.64e−05)	(2.11e−05)
Share of agriculture	−0.0509	−0.0157	−0.0162	−0.0163	−0.00798	−0.0121
	(0.0535)	(0.0458)	(0.0461)	(0.0461)	(0.0485)	(0.0495)
Share of manufacturing	−0.0347	−0.0230	−0.0232	−0.0239	−0.0240	−0.0168
	(0.0239)	(0.0227)	(0.0225)	(0.0225)	(0.0211)	(0.0231)
Share of construction	0.120	0.0991	0.114	0.116	0.107	0.0571
	(0.0839)	(0.0753)	(0.0764)	(0.0770)	(0.0801)	(0.0791)
Share of market services	−0.0380	−0.0578	−0.0646	−0.0660	−0.0676	−0.0327
	(0.0435)	(0.0423)	(0.0443)	(0.0444)	(0.0422)	(0.0415)
Human capital		0.116***	0.116***	0.115***	0.120***	0.120***
		(0.0238)	(0.0241)	(0.0240)	(0.0242)	(0.0251)
Innovation efforts		−0.00122***	−0.00122***	−0.00124***	−0.00126***	−0.00131***
		(0.000345)	(0.000350)	(0.000355)	(0.000348)	(0.000349)
Life Long Learning					−0.0441	−0.0425*
					(0.0272)	(0.0250)
EU15			0.628	0.756	0.324	−0.207
			(0.492)	(0.570)	(0.505)	(0.407)
EA16				−0.109	0.367	0.589*
				(0.209)	(0.349)	(0.350)
Constant	0.731	0.613	0.445	0.477	−0.226	−0.552**
	(0.539)	(0.491)	(0.468)	(0.475)	(0.639)	(0.236)
Observations	248	248	248	248	245	245
Adjusted R^2	0.076	0.198	0.202	0.200	0.209	0.178
Macro−econ. vars.	Yes	Yes	Yes	Yes	Yes	No

The macroeconomic controls included in Models one to five are: current account balance, emerging markets, FDI net balance and public debt.
Robust standard errors in parentheses ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

variable to the analysis, to account for Life Long Learning education, which we proxy by the regional share of adults in education and training. As columns five and six show, the new variable shows a negative (but only marginally significant) coefficient, while human capital and innovation are virtually unchanged after its inclusion.

Conclusions

Building on earlier research (cf. Brakman et al., 2015; Groot et al., 2011), this article analyses the spatial heterogeneity of the post-2008 economic landscape of the European Union. The first part mapped the spatially differentiated impacts of the crisis on key performance indicators. The subsequent part of the analysis tried, as much as possible under the constraint of data availability, to explore the potential links between pre-crisis macroeconomic and regional resistance factors that may have contributed to exacerbate/mitigate the short-term contraction of the various regional economies. Three key conclusions emerge from the empirical analysis.

First, contrary to the common belief channelled by the media, the geography of the impacts of the crisis cannot be captured by a simple North–South divide. The analysis of post-2008 regional economic trends unveils a complex core-periphery pattern. A core

continental area, where the impacts of the crisis have been low or moderately low, revolves around Germany, most of Poland, and partly stretches to neighbouring regions (such as most regions of Slovakia and the Czech Republic). This 'core' is surrounded by a ring of more peripheral areas where the impacts have been high/very high and which include most of the regions of Ireland, Spain, parts of Italy, Greece, Cyprus, Lithuania, Latvia and Estonia.

Second, the descriptive analysis of the link between the post-2008 economic performance and pre-crisis national macroeconomic factors highlights the importance of national trade patterns and government expenditure. A healthy current account surplus is associated with a stronger economic performance and better regional employment levels during the post-2008 recession. Conversely, high public debt countries are more successful in sheltering their regional economies in the short run, both in terms of economic output and employment. Of course, this result does not necessarily suggest a sustainable long-term pattern but provides preliminary evidence on the importance of active government policies before the crisis in mitigating the short-term impacts of subsequent recessionary shocks.

Third, when turning our attention to regional resistance factors, the results suggest that sectorial specialization patterns are not decisive in explaining the short-run depth of the economic crisis. Human capital is the single most important regional factor associated with a better resistance to economic shocks. Conversely, R&D-intensive regions are not well positioned in terms of their short-run reaction capacity. What matters in terms of short-run regional resistance is the capability of the regions to identify short-term innovative solutions to a changing (and more challenging) external environment. This capability does not necessarily derive from technology-driven processes supported by R&D investments but is more likely to be boosted by a skilled labour force that enhances rapid process and organizational innovation. On the contrary, when looking at short-term changes in regional employment levels, the shares of agriculture and construction sectors have a strong negative influence while R&D and human capital do not play a univocal role. Finally, our results unveil the significant divide between the regions of the 'old' Europe and the new member states. In the 'new' members states—and in particular in the regions of Poland, Slovakia and the Czech Republic—the positive post-2008 economic performance seems to be driven by a process of structural and technological catching-up while still benefiting from the relatively recent integration into the EU. Such process seems to be able to 'balance' the generalized downturn. To assess whether regional resistance 'soft factors' will be able to positively influence the recovery in the medium run, it will be necessary to wait for more updated data on economic performance and employ more sophisticated statistical techniques to single out the contribution of the different factors.

End Notes

[1] It is necessary to stress that the data presented in our map for Greece and Cyprus is not completely representative of the impacts experienced by the two countries, since most of the contractions in Greece and Cyprus occurred after 2010, i.e. after the period covered by our data.

[2] Lane and Milesi-Ferretti (2010) include pre-crisis economic output growth rates, rather than levels. We prefer to include the latter to follow the literature on economic convergence, and because pre-crisis growth rates may capture above-trend growth (i.e. economic booms). Results not presented here but available on request show that results are overall robust to the adoption of a specification similar to Lane and Milesi-Ferretti (2010).

[3] While the adoption of R&D spending as a % of GDP may be more usual, we prefer GERD since we have data on it for more regions than the former—one of our aims is to cover as many EU regions as possible. Reassuringly, the pairwise correlation coefficient between the two is 0.74 (significant at the 5% confidence level), while additional tests not

included in the article but available on request show that replacing the two does not alter the overall results.

[4] We thank one anonymous referee for raising this issue.

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Table A1. Description and sources of data

Variable	Description	Unit	Source
GVA growth rate	Average annual growth rate of per-capita regional Gross Value Added during 2008–2010	% points change	Own calculations from Cambridge Econometrics
Employment growth rate	Average annual growth rate of total regional employment during 2008–2010	% points change	Own calculations from Cambridge Econometrics
Initial GVA	Per-capita average regional Gross Value Added during 2004–2007	€ in constant 2000 prices	Own calculations from Cambridge Econometrics
Current account balance	Average current account balance in % of national GDP during 2004–2007	%	Eurostat
Emerging markets	Average share of export to emerging economies (non-EU28 and non-advanced economies) on total national export during 2004–2007. We follow the IMF list of advanced economies	%	Own calculations from Eurostat
FDI net balance	Average FDI stock net balance during 2004–2007, calculated as the difference between outward and inward FDI stocks as a share of national GDP	%	Own calculations from UNCTAD
Public debt	Average government consolidated gross debt as a share of national GDP during 2004–2007	%	Eurostat
Share of agriculture	Average share of regional GVA in agriculture on total regional GVA during 2004–2007	%	Own calculations from Cambridge Econometrics
Share of manufacturing	Average share of regional GVA in manufacturing and energy on total regional GVA during 2004–2007	%	Own calculations from Cambridge Econometrics
Share of construction	Average share of regional GVA in the construction sector on total regional GVA during 2004–2007	%	Own calculations from Cambridge Econometrics
Share of market services	Average share of regional GVA in market services on total regional GVA during 2004–2007	%	Own calculations from Cambridge Econometrics
Human capital	Average percentage of adult population aged 25–64 holding a degree in tertiary education during 2004–2007	%	Eurostat
Innovation efforts	Averge per capita total intramural R&D expenditure (GERD) during 2004–2007	PPS €, constant 2005 prices	Eurostat
Life Long Learning	Participation of adults aged 25–64 in education and training	%	Eurostat
EU15	Dummy = 1 for EU15 countries	Dummy	Own calculation
EA16	Dummy = 1 for countries part of the Eurozone at the time of the crisis (including Slovakia, which entered in January 2009)	Dummy	Own calculation

Table A2. Summary statistics of data

Variable	Mean	Std. dev.	Min	Max
GVA growth rate	−0.75	2.64	−6.53	7.77
Employment growth rate	−0.41	1.44	−5.67	4.03
Initial GVA	18,763.47	10,526.33	1522.84	74,610.74
Current account balance	−1.24	5.08	−13.93	10.68
Emerging markets	23.36	5.99	7.70	33.99
FDI net balance	−2.05	24.59	−71.09	25.70
Public debt	57.62	23.99	4.43	104.75
Share of agriculture	3.71	3.51	0.01	16.88
Share of manufacturing	23.84	9.10	3.90	53.17
Share of construction	6.45	2.24	2.27	15.34
Share of market services	21.57	6.53	8.39	50.52
Human capital	22.39	7.98	7.40	45.60
Innovation efforts	358.75	376.31	6.55	1935.85
Life Long Learning	10.43	7.95	0.68	33.00
EU15	0.79	0.41	0	1
EA16	0.63	0.48	0	1