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## ECONOMIC CRISIS AND REGIONAL DEVELOPMENT IN GREECE

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**Abstract** - This paper sets out to examine the determinants of regional development in Greece before and during the economic crisis. By proposing an econometric model with spatial effects for the years 2005-2008 and 2009-2011, which represent the sub-periods of growth and decline of the Greek economy respectively, we make it possible to capture the different factors that affect the regional economic development of the NUTS III regions in the country. Results highlight that the most urbanized and high income level regions are more affected by the economic crisis. However, these regions had been the ones that most benefited during the upturn of the economic activity. The same applies to the regions that are based on agriculture, which had benefited during the period of economic development but cannot sustain the gains of development during the recession. Specialization in manufacturing is an important determinant of regional development, either in times of growth or in times of crisis, while tourism generates benefits to the neighbouring regions in times of economic crisis. These results are also tested for geographical subsets of the country such as the North-South divide and regions belonging to the development axis of the country (PATHE) versus the rest regions of the country.

**Key words** - ECONOMIC CRISIS, REGIONAL RESILIENCE, REGIONAL DEVELOPMENT, GREECE

**JEL Classification** - R11, R12, C21, C23, O21

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## 1. INTRODUCTION

The reaction of regional economies during the economic cycle has been a longstanding issue in the literature of regional analysis and policy. While gains from growth or losses from recession are highly unevenly distributed across space, the underlying causes and circumstances that could offer plausible explanations to such differences are still open to debate. Theories of regional development offer contradictory views, while empirical research yields highly diversified findings based on different country experiences, methodological frameworks and availability of data.

In this paper we try to identify the determinants of regional economic development in Greece for the period 2005-2011. This period has some distinct characteristics that make Greece an interesting case study. During this period, the Greek economy experienced both economic growth and decline. For this reason, the entire period 2005-2011 has been divided into two sub-periods, 2005-2008 and 2009-2011, which represent periods of economic growth and recession respectively.

The year 2005, which is the starting year of our analysis, is the median year of the decade that started with the establishment of Eurozone which Greece joined in 2001. In addition, this year highlights the post-Olympic-Games period for the country. Throughout the decade and also during that period 2005-2008, the Greek economy showed well above the European average annual percentage growth rate in terms of its economic activity. The year 2009 highlights another turning point, with the start of the most severe, and still-evolving, economic crisis the country has experienced during its modern history. The impact of the crisis on the level of economic prosperity and living conditions for people and territories is still a little known and discussed issue and as such it constitutes a promising area for scientific investigation.

This paper tries to set out to examine the interrelation between space and economy and investigates how the gains from development are distributed throughout different territories of the country, and also how losses from recession are spread and divided between different areas of the country. The principal goal of our paper is to identify and compare the drivers of regional development in Greece before and during the economic crisis.

We also attempt to see how these determinants are differentiated by the geographical subsets of national economy, such as for the regions that belong to the development axis of the country (known as PATHE) versus the rest of the country (Non-PATHE), as well as regions based on the North-South divide of the country.

This attempt is supported by a newly elaborated dataset with socio-economic, demographic and geographical variables, which capture different aspects of the morphology of NUTSIII regions of the country. Analysis which uses descriptive and spatial econometric analysis techniques offers some interesting insights for the determinants of the development in space.

This paper communicates with and contributes to the literature in many ways. Firstly, it makes an empirical attempt to study what determines the level of regional development in the country during periods of growth and recession. Secondly, it is related to regional resilience, which has been one of the core issues regarding the geography of crisis effects. Thirdly, analysis is conducted at the prefectural NUTS III level, which comprises a geographically disaggregated level, which in turn makes it possible to capture the crisis impact on relatively smaller areas. Fourthly, it applies spatial econometric analysis techniques accompanied with other descriptive methods of regional analysis, such as thematic mapping. Fifthly, analysis is based on a newly elaborated dataset with variables that capture socio-economic and demographic effects expected to explain the variation in the level of economic development across Greece. Finally, it provides evidence from a cohesion country for which regional development has been a policy priority for years. As a result, economic crisis puts at risk and also questions the viability-sustainability and resistance of regional economies to the crisis.

Summing up, the unique and timely dataset, the geographical level of analysis and the methodology applied give this study attempt a novelty that could communicate with the international audience and could offer insights from a country that was severely hit by the recent economic crisis and which was placed at the heart of economic discussion regarding interpretations of and responses to overcoming the current economic crisis.

## **2. LITERATURE REVIEW – ESTIMATING CRISIS IMPACT ON REGIONAL DEVELOPMENT**

Fluctuations of the economic cycle, apart from the impact they have on national economy, have a distinct geographical dimension that has been a longstanding issue in regional analysis and policy literature. The upward ‘tide’ of economic activity generates benefits for the national economy that are spread geographically in a fairly unbalanced way (Richardson 1973: 138). Conversely, the downward trend of economic activity incurs costs that affect the economy of the regions across the country (Stillwell 1980). The rising and lowering tide spreads benefits and incurs costs in different geographical areas of a given economy that are subject to theoretical and empirical interpretations from different theoretical standpoints and scientific disciplines (Borts 1961; Myrdal 1957; Berry 1988; Krugman 1991).

In recent decades, the bulk of development literature has given relatively more attention to the growth performance of countries and regions rather than the determinants of the level of economic development (OECD 2009b: 13). This is probably due to fact that growth has been considered as the end-result of the economic activity and crises have been seen as the short-lived episodes of an unavoidable tendency to higher and converging levels of economic development. However, the intensity and duration of the current economic crisis, along with the unprecedented impacts it has had on people’s lives and territories, has triggered a new surge of research regarding the impacts of the crisis on

the level of economic and regional development (OECD 2009a: 13; Bachtler and Davies 2009). The question of what makes regions able to achieve and sustain a high level of economic development and which factors hinder the development potential and make regions more vulnerable to crises has (re)gained important salience these days.

One strand of the literature attempts to assess the heterogeneous impact of global recession on individual European countries and regions (De Groot *et al.* 2011). The overall conclusion of this analysis is that variation in the sectoral composition contributes to the variation of the current crisis impact at both country and regional level across the EU. However, as mentioned before, due to the lack of recent statistical data there are few examples of this type of research.

Other scientists have tried to investigate the impact of real estate and mortgage market crisis on cities and local economies, as the current crisis began as a crisis in the financial and real estate markets. Aalbers (2009) argues that the housing bubbles and changes in regulation in the financial sector dictated, to a large extent, the geography of the financial crisis at state and city level in the US (Aalberts 2009: 34). Martin (2011) depicts the geography of recession by analysing the locally varying impact of global credit crunch at macro and micro geographical levels in the USA. He concludes that geography stands as an essential element for analysing economic crisis. Holly *et al.* (2011) analyse the spatial and temporal diffusion of house prices in the UK, developing a model which captures the diffusion of the crisis across cities and regions in the real estate market. Marshall *et al.* (2012) offer another viewpoint of the credit crunch, with the collapse of Northern Rock in 2007, connecting this case with the peripheral financial region of Newcastle (where Northern Rock was based).

Another strand of research, which has been receiving growing attention, analyses the impact of the crisis on regional levels of unemployment. OECD (2011a) highlights the differentiated impact on the loss of jobs within OECD countries due to economic recession. Mussida and Pastore (2012) analyse regional unemployment in Italy and find that labour turnover is related to the regional unemployment rate and determined by structural change. Fingleton *et al.* (2012) investigate the effects of recessionary shocks in regional unemployment, with reference to UK regions during the period 1971-2010, and provide evidence that there are quite large differences in the way that regions react to recessionary employment shocks. Patuelli *et al.* (2012) use spatial filtering techniques to depict the geographical distribution and persistence of regional/local unemployment rates in Germany, and find widely heterogeneous but generally high persistence in regional unemployment rates.

Another notion that is central to the geography of economic crisis is that of “resilience”. Martin (2012) develops the idea of resilience and examines its usefulness as an aid to understanding the reaction of regional economies to major recessionary shocks; he makes a preliminary empirical analysis of previous and recent crises in UK regions. In another relevant paper, Foster (2012) points out that resilience represents both the capacity to respond to a shock and the performance of a region once a shock has occurred. Then, she proceeds with a construction of a regional resilience index and applies it to USA cities. Bristow

and Healy (2014), placing specific emphasis on the role of human agency, argue that the inclusion of the human factor in resilience thinking ultimately means that the role of place and context must assume greater significance.

As regards Greece, the regional impact of economic crisis has been given limited attention by the literature. In a recent paper, Psycharis *et al.* (2014) investigate the impact of economic crisis on the Greek regions with the use of a composite indicator, and find that metropolitan regions are more vulnerable to economic crisis while islands more resilient. Monastiriotis (2011) analyses the impact of austerity measures on regional income and inequalities, arguing that the horizontal measures are widening existing disparities – something that may be difficult to redress in the future. Bakas and Papapetrou (2012) examine the nature of Greek unemployment allowing for cross-sectional dependence among Greek regions, and suggest that structural breaks should be taken into account when considering general models that relate unemployment to other macroeconomic variables, at national and regional level within Greece. From another more critical perspective, Hatzimichalis (2011) discusses certain issues of regional development theory in combination with the conditions of uneven geographical development, and the shift towards what we may call the neoliberal urban and regional development discourse, and he questions the lack of socio-spatial justice in the austerity policies applied in the cohesion countries. Regional inequalities during economic crisis were the focus of a research attempt by Caraveli and Tsionas (2012), who argue that the current debt crisis and the fiscal measures have put a strain on the regional economies most heavily dependent on public sector employment and investment.

However, there is a dearth of research on modelling the regional effects of economic crisis in the Greek regions. Today, the relatively higher availability of statistical data makes it possible to make a quantitative assessment of crisis impact on regional output and development. Our model examines the dynamics of regional development in Greece for the period before and after the economic crisis hit Greece. This approach will allow us to delve into the underpinnings of the development and decline of Greek regions and to highlight the determinants which may prove important for interpreting the regional impact of a crisis and detecting ways out of it.

Our attempt, supported by a newly elaborated dataset is aiming at filling, at least in part, the gap in existing literature on the regional impact of an economic crisis, and communicates with the international debate on these issues.

### **3. MAPPING REGIONAL DEVELOPMENT SOME STYLIZED FACTS**

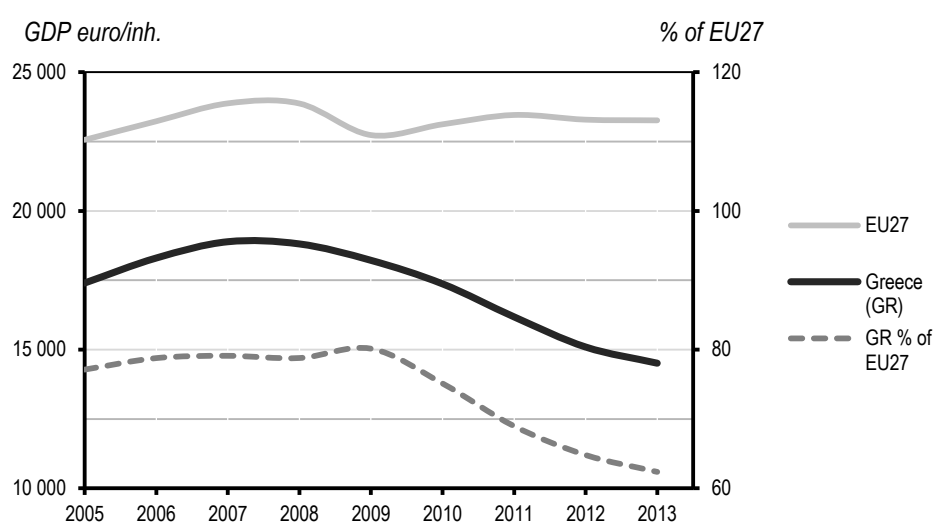
In this part of the paper we present some stylized facts regarding the evolution of the level of economic development of Greek regions during the period 2005-11 and the two sub-periods 2005-08 and 2009-11.

#### **3.1. Trends in national economy**

Figure 1 portrays the evolution of GDP per capital for Greece and the EU-27 over the period 2005-2011 and shows that post-2009 Greece has experienced a

clear divergence trend compared with the average EU-27 level of economic development. This steady divergence contradicts the convergence process that was observed for Greece during the previous years of the decade. While the EU 27 shows signs of stabilization, Greece is converging steadily. This divergent trend, which reflects the polarization of the emerging new economic geography in Europe, is something that can be highlighted before we turn to the regional impact of economic crisis.

**Figure 1. GDP per capita of Greece as percentage (%) of EU27 average**



Source: AMECO online database - accessed at 26.08.2014, own calculations.

**Table 1. Gross domestic product volume and per capita 2005-2013, EU27 and Greece**

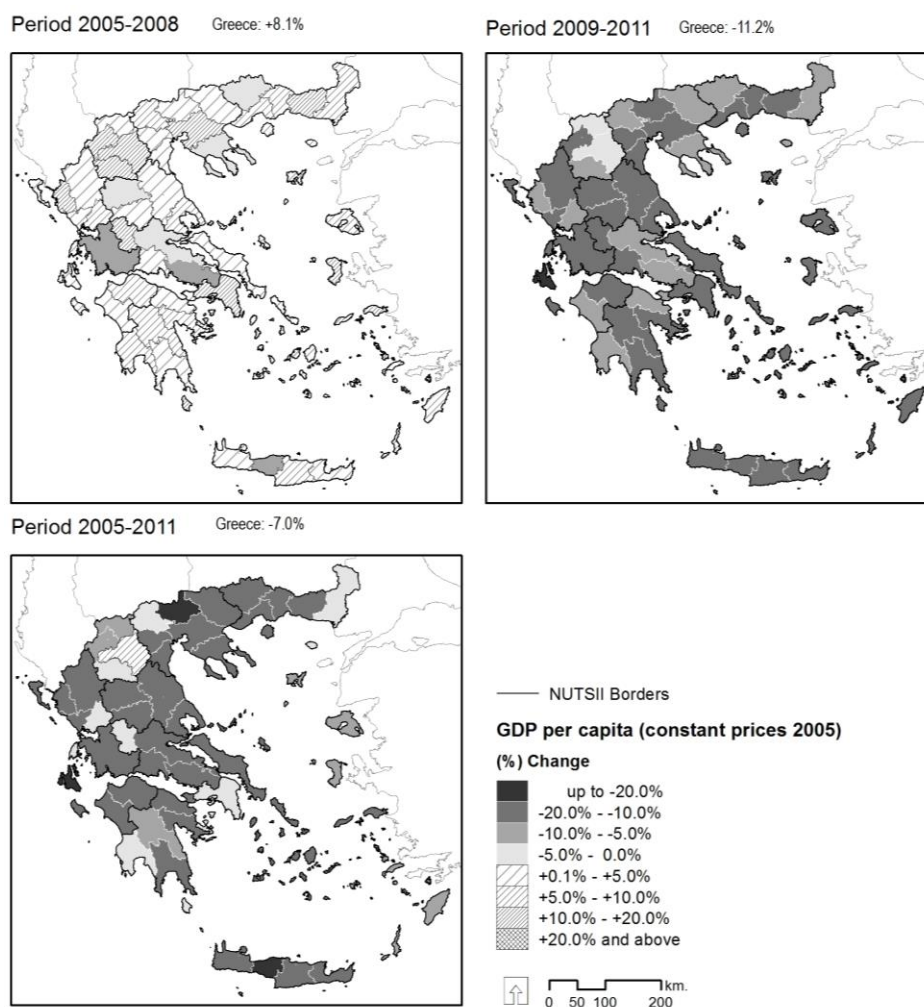
Variable	Unit	Change (%)			Compound Annual Growth Rate - CAGR (%)		
		2005-08	2009-13	2005-13	2005-08	2009-13	2005-13
Gross domestic product (constant prices 2005)	European Union (27 countries)	7.1%	3.41%	5.7%	2.3%	0.84%	0.7%
	Greece	9.0%	-21.02%	-16.6%	2.9%	-5.73%	-2.2%
Gross domestic product per capita (constant prices 2005)	European Union (27 countries)	5.8%	2.34%	3.1%	1.9%	0.58%	0.4%
	Greece	8.1%	-20.35%	-16.6%	2.6%	-5.53%	-2.2%

Source: AMECO online database - accessed at 26.08.2014, own calculations.

Table 1 provides some facts on the growth dynamics during this period. As the table shows, the annual growth of the Greek economy during the period 2005-2008 has been much higher than the European average. The reversed

trend is observed for the period 2009-2013, which shows negative growth rates much higher than the EU average. As a result, high growth rates in the first period are accompanied with convergence of the Greek economy with the European average, while the reversed growth rates of the second period are accompanied by divergent trends from the European average.

**Figure 2. GDP per capita, change (start year/end year), Greece NUTSIII spatial level**



Source: Eurostat online database [nama\_r\_e3gdp] - accessed at 26.08.2014, own calculations.

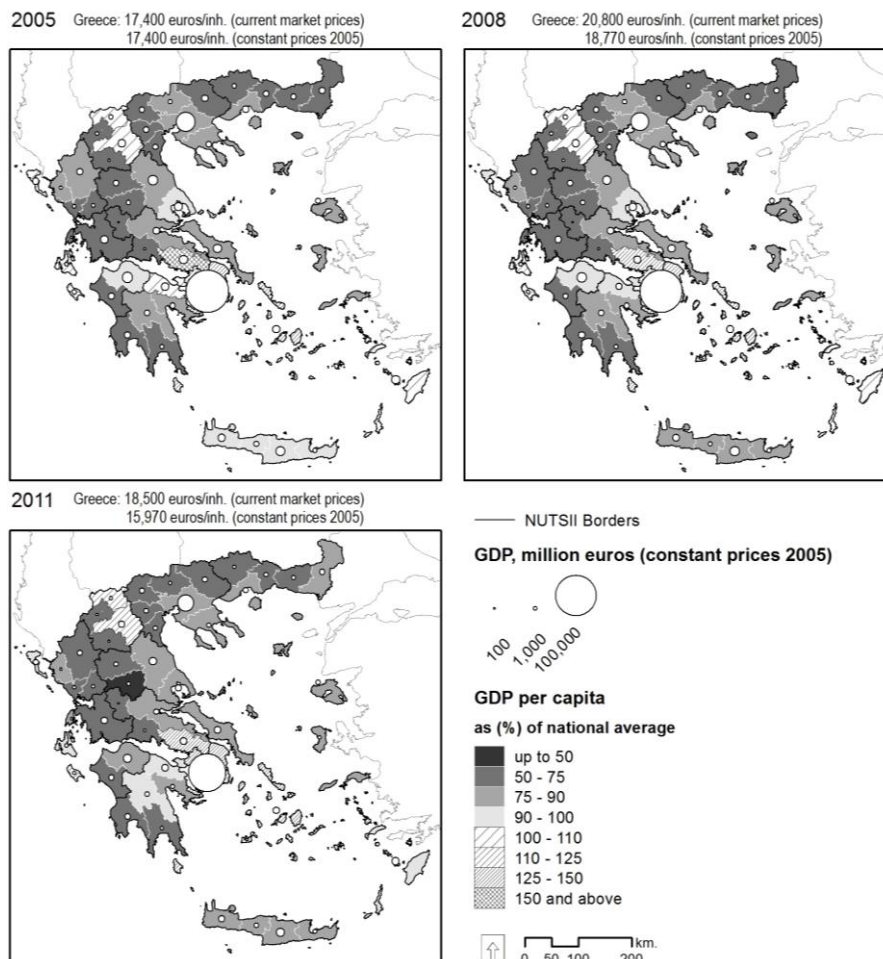
### 3.2. Trends in regional growth

Now we can look at how these trends at national level are reflected at regional level. Figure 2 demonstrates that the growth performance of the economy

during the period 2005-2008 is far from being equally distributed among the regions of the country. In addition, the economic decline during the period 2009-2011 shows a far from homogeneous spatial pattern.

The upward trend of economic activity during 2005-2008 includes almost all the NUTS III regions/prefectures of the country, with the exception of Voiotia, the neighboring region to Attiki and where the manufacturing activity of Attiki has been exported, the agricultural based prefecture of Aitoloakarnania in Western Greece and the prefecture of Rethymno in Creta. However, for the rest of the prefectures, the positive growth rates show a much more diversified growth pattern.

**Figure 3. GDP per capita as percentage (%) of the national average, Greece NUTSIII spatial level**



Source: Eurostat online database [nama\_r\_e3gdp] - accessed at 26.08.2014, own calculations.

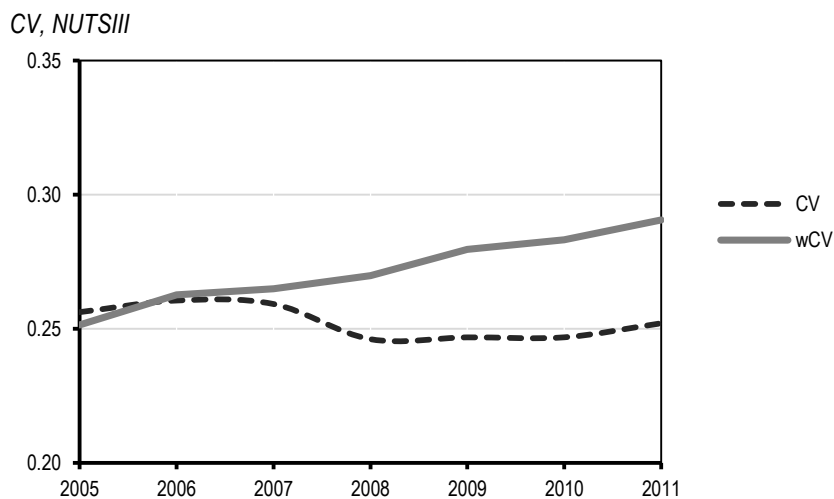


The downwards trend of the period 2009-2011 affects all the NUTS III regions of the country. As a result, for the period 2005-2012 the majority of prefectures showed negative growth rates, with a few exceptions, including Kozani, which is the location of electrical production in Greece. Attiki stands out as one of the least affected and this is an important case because it includes Athens the capital city of Greece, and because the relative value of its economy accounts for almost 40% of the economic activity of the country. Other interesting cases include the prefectures of Grevena in Epirus, Evros in the north-east, Messinia in the south-west and Evritania and Arta in central-western Greece, and Pella in the north.

### 3.3. Trends in regional development and inequalities

Now we can study the map of regional development in Greece at NUTSIII level in comparison with the country average. Figure 3 shows the maps for regional GDP per capita as a percentage of the national average for the years 2005 (the starting year of the period under consideration), 2008 (the year before the start of the economic decline) and 2011 (the year with the latest available data on GDP at regional level). At constant prices, the GDP per capital for Greece in the year 2005 was 17,400 euro, in the year 2008 it was increased to 18,770, an increase of 7.8%. However, in 2011 it reduced to 15,970 indicating a fall of -14.9%. The lowering of the level of economic development of the country has impacted on the level of economic development of the regions.

**Figure 4. Regional inequalities in Greece: coefficient of variation 2005-2011**



Source: Eurostat online database [nama\_r\_e3gdp] - accessed at 26.08.2014, own calculations.

As Figure 3 shows, the regional pattern of economic development has remained relatively stable throughout the study period and there are only a limited number of NUTS III regions that enjoy levels of economic development above

the country average; these prefectures include Attiki, and its neighbouring prefectures, the Aegean Islands and Crete, as well as Kozani and Grevena, prefectures that are key energy suppliers for the country.

These trends have impacted on the level of regional inequalities across the country. As Figure 4 portrays, the coefficient of variation weighted with population shows that inequalities increase during the years of an economic crisis. However, using the simple coefficient of variance as a measure for regional inequalities, we can see that regional inequalities decrease after 2006 and remain stable during the economic crisis.

Summing up the finding of this section, we can observe the divergent trend of Greece from the European average, the relatively stable pattern of regional development, and the increase in regional inequalities.

#### **4. MODELLING DETERMINANTS OF REGIONAL DEVELOPMENT**

##### **4.1. Description of variables**

The variables that are included in the analysis stand for socio-economic, demographic and geographic features of the regional economies in Greece. Analysis is conducted at the NUTS III geographical level in the country. According to the recent administrative reform, these geographic units are sub-parts/subdivisions of the second tier of local government.

The dependent variable is *GDP per capita*, which stands for the level of economic development (Hellenic Statistical Authority, market prices). This indicator corresponds to one of the standard variables that have been found significant in growth and development models within neoclassical, endogenous or NEG theories (OECD 2009).

The explanatory variables include *urbanization*, *secondary sector*, *agriculture*, *tourism*, and *declared income*.

*Urbanization* has been measured by *Population density* of NUTS III regions. This variable has always been a standard variable in economic development models since it proxies agglomeration economies and market size. Literature suggests the differentiated impacts of crisis on cities and regions (Stilwell 1980, De Groot *et al.* 2012). Large agglomerations are more exposed to crisis and therefore sometimes experience higher impacts than the less-developed areas. However, these areas usually recover earlier than the rest of the country and become drivers of economic recovery.

*Secondary sector (Manufacturing) and Agriculture* are variables that proxy sectoral composition in regional economies, and question whether regional specialization in manufacturing or in agriculture account for the differentiation of the impact of a crisis across regions.

*Tourism* is another important factor for the level of economic development of the regions. In this model, we make use of total number of overnight stays of tourists in NUTSIII regions of the country.

*Declared income* reflects the level of prosperity among individuals across regions and is considered to be an important factor during a crisis.

#### 4.2. Model specification

The empirical calibration of the economic development model includes a rather large set of independent variables, as described above. The calibrated equation has the form:

$$GDPperCapita = f(\text{Urbanization, Agriculture, Secondary Sector, Tourism, Income})$$

The dataset has a relatively small time dimension, i.e. it covers the period 2005 to 2011, and a relatively larger cross-sectional dimension, i.e. the fifty one Greek prefectures (that is NUTS III regions in the European nomenclature). The estimated equation in compact form will be:

$$y_{it} = \alpha + \beta X_{it} + u_{it}$$

where subscript  $i$  denotes the cross-section dimension,  $t$  the time-series dimension,  $y_{it}$  is the dependent variable,  $X$  the  $i^{th}$  observation on  $K$  explanatory variables (not including the constant term),  $\alpha$  is a scalar, and  $\beta$  is of  $M \times 1$  dimension. Finally,  $u_{it}$  is the disturbance term.

In the subsequent analysis, several different types of regression are employed; also different parts (subsets) of the basic dataset are used, differentiated either spatially or temporarily. Ordinary Least Squares (OLS), Panel Data Fixed Effects (FE), and Panel Data Random Effects (RE) were estimated, but only the FE results are reported here, as FE is the “preferable” estimation, based on the Hausman test (*see*, for instance, Baltagi 2008). Actually, we also used the robust version as suggested by Wooldridge (2002), which produced similar results rejecting RE estimators (these tests, as well as, OLS and RE estimations are available upon request). All sets of results are corrected for the presence of heteroskedasticity and serial correlation (for the methodology used to obtain these robust errors, see Arellano 1993 or Wooldridge 2002). In “compact” form, the panel estimators will be:

In the one-way Fixed Effects context, the disturbances will be:

$$u_{it} = \mu_i + \varepsilon_{it}$$

where  $\mu_i$  denotes the unobservable individual specific effects and  $\varepsilon_{it}$  denotes the remainder disturbances. The FE estimators are computed on the assumption that the unobservable individual effects are fixed parameters and the remaining disturbances are independent and identically distributed (for the several alternative ways by which panel data estimators can be obtained, and give numerically identical results, see for instance, Baltagi 2008, or Greene 2011).

The Random Effects regression will be:

$$y_{it} = \alpha + \beta X_{it} + u_{it}$$

where, all symbols are as previously, but the error term now takes the form:

$$u_{it} = v_i + \varepsilon_{it}$$

where  $v_i$  are random variables (i.i.d. random-effects); the  $\text{Cov}(x_{it}, v_i) = 0$  and the  $\varepsilon_{it}$  term denotes the remainder disturbances.

A potential problem is that the error terms are serially correlated and their standard errors are biased. A pooled GLS estimator provides here the Random Effects estimator (for the transformation procedure see, for instance, Baltagi 2008, or Greene 2011). As stated earlier, the results of RE estimators are available upon request.

The geographic nature of the data enabled the use of spatial regressions. There is now available an array of potential models to estimate spatial regression (Lesage and Pace, 2009, survey most of these models). Here, two of the most popular models, the Spatial Autoregressive Model (SAR) and the second the Spatial Error Model (SEM), have been used.

The SAR model has the compact form:

$$y_{it} = \rho * W * y_{it} + \beta X_{it} + \alpha_i + u_{it}$$

where  $W$  is the (spatial) weights matrix,  $\rho$  is the spatial autoregressive coefficient, and all other notation as before (for the  $u_{it}$  the classical assumptions are assumed). In the Spatial Autoregressive Model (which is also called Spatial Lag Model) setting it is assumed that the values of the dependent variable  $y$  in spatial unit  $j$  depend on the values of  $y$  in neighbouring spatial units; in this way SAR model captures “spatial spill-overs”. If coefficient  $\rho = 0$ , there is no spatial dependence, which means that the dependent variable  $y$  does not depend on the values of  $y$  in neighbouring spatial units.

The Spatial Error Model has the form:

$$y_{it} = \beta X_{it} + \alpha_i + v_{it}$$

where  $v_{it}$ :

$$v_{it} = \lambda * W * v_{it} + u_{it}$$

where  $\lambda$  is the spatial error coefficient, and all other notations are as before. It can be argued that SEM is the spatial analogous of the temporal correlation process. If there is no spatial correlation between the error terms, then the coefficient  $\lambda$  equals zero.

The SAR and SEM models in a panel data context can be estimated in fixed and random effects specifications (Lee and Yu 2012). LeSage and Pace (2009)

have argued that the answer to the question ‘which of these models is the “correct” one’ is dictated by the specific empirical context.

In the estimation of spatial regression, one crucial factor is the selection of the “proper” spatial weights. Here the spatial weight matrix was calculated with the use of “3-nearest neighbours” method<sup>1</sup>. The reason for this is that Greece has a significant number of (real) islands which should be integrated into the spatial regression analysis; Ertur and Le Gallo (2003), who have argued that spatial weight matrices based on the *k*-nearest method, are preferable to the simple contiguity matrices for a number of reasons, such as in the aforementioned case of islands (that is to avoid rows and columns in the *W* matrix with only zeros). The use of *k*-nearest method also ensures that the number of neighbours is ‘fixed’ and thus avoids potential methodological problems (for a more extensive analysis, see for instance, Lopez-Bazo *et al.* 1999 or Ertur and Le Gallo 2003).

## 5. EMPIRICAL RESULTS

Table 2, with the variables’ correlations matrix, shows that all pairwise correlations are relatively low. Table 3 presents some descriptive statistics.

**Table 2. Correlation Matrix 2005-2011**

	GDPpc	Urbanization	Agriculture	Secondary Sector	Tourism	Income
GDPpc	1.000					
Urbanization	<b>0.376</b> 0.000	1.000				
Agriculture	<b>-0.531</b> 0.000	<b>-0.317</b> 0.000	1.000			
Secondary Sector	<b>0.349</b> 0.000	-0.110 0.038	-0.028 0.600	1.000		
Tourism	<b>0.378</b> 0.000	<b>0.423</b> 0.000	<b>-0.382</b> 0.000	-0.246 0.000	1.000	
Income	<b>0.466</b> 0.000	<b>0.405</b> 0.000	<b>-0.513</b> 0.000	-0.010 0.846	0.247 0.000	1.000

The regression results are presented in Tables 4 to 5; all these tables show firstly three columns regarding the estimates for all regions (prefectures, i.e. NUTS III units), one column with results for PATHE prefectures, one column for Non-PATHE prefectures, one column for northern Greece prefectures, and one column for southern Greece. PATHE is the acronym for the main highway of Greece, linking the port (and city) of Patras in south-western Greece, with the northern borders of Greece, via the metropolitan area of Athens and Thessaloniki. The rationale for the breakdown of the dataset in northern and southern Greece is to investigate the idea that the two main parts of the country have experienced different paths of development and different patterns of crisis. The

<sup>1</sup> It has to be noted that the use of other spatial weights schemes, such as the minimum threshold distance gave, more or less, similar results.

rationale behind the breakdown of the dataset to PATHE prefectures and Non-PATHE prefectures is to explore the idea that PATHE prefectures comprise the “growth” axis of the country (in the Greek bibliography these prefectures are called the “S of growth” as their spatial shape resembles the letter “S”; see Petrakos and Psycharis 2014 for this point).

**Table 3. Descriptive statistics**

Variable	Obs	Mean	Std. Dev.	Min	Max
<i>Period 2005-2008</i>					
<b>GDPpc</b>	204	15883.620	4140.581	9469.697	29423.530
<b>Urbanization</b>	204	78.289	146.939	10.700	1070.600
<b>Agriculture</b>	204	7.983	4.521	0.371	22.154
<b>Secondary Sector</b>	204	22.628	11.706	8.432	64.720
<b>Tourism</b>	204	1196595.000	2184492.000	22685.000	13000000.000
<b>Income</b>	204	6217.930	1026.732	3899.787	10597.550
<i>Period 2009-2011</i>					
<b>GDPpc</b>	153	15952.890	4002.575	9281.812	28054.610
<b>Urbanization</b>	153	79.210	150.168	10.600	1080.400
<b>Agriculture</b>	153	6.883	3.775	0.363	18.923
<b>Secondary Sector</b>	153	18.980	11.968	5.396	62.687
<b>Tourism</b>	153	1331180.000	2430922.000	22237.000	15300000.000
<b>Income</b>	153	7622.028	1135.681	5221.048	13510.600

Table 5 of the regression results replicates the first Table by using the same spatial breakdowns; however, the former Table refers to the pre-crisis period 2005-2008, and the latter, to the crisis period, 2009-2011. As growth trends show, the crisis in Greece was evident in 2009.

A first, general, conclusion which can be drawn from these tables is that results are “stable” across specifications, and spatial and temporal breakdowns. Moreover, the statistics for spatial regression (spatial rho and lambda) are positive and statistically significant, showing positive spatial autocorrelation.

Analysis regarding comparative assessment of regional development for the pre-crisis and crisis periods for Greece has yielded some interesting results.

The first important finding is that agglomeration economies, proxied by population density (*Urbanisation*), have always been a statistically significant determinant in explaining regional development in the country. However, while urbanization is positively related with the high rates of economic development, it turns to be a negative and statistically significant determinant for the level of economic development during economic decline. These results indicate that the most urbanized areas are the ones that are more vulnerable to economic crisis. However, these areas had been the ones that have benefited most during the upturn of the economic activity. Secondly, it seems that the same observation

applies to the level of economic prosperity of the regions, which is proxied by the declared incomes of households (*Income*). Results show disproportionately higher gains for more prosperous regions during development and disproportionately higher losses during recession. This also applies to PATHE/NON-PATHE regions as well as SOUTH REGIONS of the country.

**Table 4. Results, Time Period: 2005-2008 (Before the crisis)**

Dependent variable: gdp/capita							
	ALL REGIONS			PATHE	NON-PATHE	NORTH GREECE	SOUTH GREECE
	FE	SAR FE	SEM FE	FE			
<b>Variables</b>							
Urbanization	111.3*** (20.42)	121.1*** (16.79)	121.9*** (15.80)	60.42*** (18.61)	155.9*** (23.85)	120.4*** (22.03)	107.5*** (25.14)
Agriculture	172.4*** (27.70)	171.6*** (20.93)	179.7*** (20.54)	266.3*** (46.84)	168.4*** (32.59)	137.9** (55.05)	179.8*** (30.48)
Secondary Sector	187.9*** (23.80)	191.2*** (15.28)	200.9*** (14.90)	307.3*** (45.36)	166.2*** (26.53)	175.3*** (42.96)	181.6*** (29.98)
Tourism	-0.0000578 (0.000162)	-0.000306** (0.000140)	-0.0000808 (0.000140)	0.000453** (0.000176)	-0.0000659 (0.000189)	-0.000511*** (0.000156)	0.000109 (0.000182)
Income	2.145*** (0.108)	1.799*** (0.0918)	2.089*** (0.0874)	2.342*** (0.166)	2.157*** (0.126)	2.265*** (0.161)	2.085*** (0.132)
Constant	-11728.6*** (1758.4)			-19690.8*** (2432.2)	-10372.6*** (1708.4)	-12378.6*** (1999.3)	-11072.9*** (2324.2)
<b>Spatial</b>							
rho		0.0918*** (0.0153)					
lambda			0.188*** (0.0229)				
<b>Variance</b>							
sigma2_e		105132.8*** (10418.5)	93697.8*** (9413.3)				
adj. R <sup>2</sup>	0.885	0.252	0.185	0.923	0.874	0.901	0.876
N	204	204	204	48	156	64	140

Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

Thirdly, manufacturing (*Secondary Sector*) has always been a statistically significant driver of development during periods of growth and has shown significant resistance to crisis during recession. However, manufacturing areas proved to be more resilient to crisis. Contrary to that, the NON-PATHE and Southern agricultural areas (*Agriculture*) which had benefited from an upward turn in economic activity have turned to be more vulnerable to economic crisis while the PATHE and Northern regions are more resilient.

Tourism (*Tourism*) is positive for the level of economic development and in times of crisis generates benefits to the neighboring regions (second and third column). However, this result doesn't apply to NON-PATHE and Southern regions of the country.

**Table 5. Results, Time Period: 2009-2011 (During the crisis)**

Dependent variable: gdp/capita							
	ALL REGIONS			PATHE	NON-PATHE	NORTH GREECE	SOUTH GREECE
	FE	SAR FE	SEM FE	FE			
<b>Variables</b>							
Urbanization	-517.0*** (115.9)	-391.9*** (102.2)	-442.3*** (107.0)	-617.1*** (167.5)	-648.9** (248.9)	-584.4*** (115.7)	-486.8*** (122.9)
Agriculture	-194.9 (133.3)	-184.6** (81.23)	-214.2** (88.98)	192.2** (85.64)	-496.1*** (152.1)	64.50 (60.23)	-432.6*** (146.8)
Secondary Sector	186.1*** (36.51)	153.2*** (25.28)	127.8*** (27.70)	190.2*** (39.14)	156.2*** (44.82)	172.6*** (25.16)	188.6*** (50.61)
Tourism	- 0.000543*** (0.000133)	0.000654*** (0.000237)	0.000623** (0.000294)	-0.00375 (0.00297)	-0.000497*** (0.000166)	0.00251* (0.00127)	-0.000571*** (0.000166)
Income	-0.863*** (0.318)	-0.414*** (0.105)	-0.267** (0.114)	-1.706*** (0.404)	-0.785** (0.321)	-1.317*** (0.170)	-0.784** (0.344)
Constant	62014.2*** (9844.8)			134183.6*** (31383.3)	55855.6*** (13535.0)	55540.5*** (7943.7)	65124.9*** (11475.0)
<b>Spatial</b>							
rho		0.176*** (0.0214)					
lambda			0.230*** (0.0230)				
<b>Variance</b>							
sigma2_e		158965.7*** (18312.1)	184207.9*** (21666.8)				
adj. R <sup>2</sup>	0.648	0.248	0.150	0.851	0.614	0.744	0.625
N	153	153	153	36	117	48	105

Standard errors in parentheses. \*  $p < 0.10$ , \*\*  $p < 0.05$ , \*\*\*  $p < 0.01$ .

## 6. CONCLUSIONS AND POLICY IMPLICATIONS

The Great Recession that started in 2008 has offered new insights into the complexity of economic development and has brought up new ways of thinking and interpreting economic activity and its connection to the economy of the regions. The ways in which gains from growth and losses from recession are channeled to different regions of the country is a complex result of interrelations and connections between regional economies, the national economy and the international economy.

Analysis showed that crisis has impacted on different geographical levels. Firstly, crisis re-shapes the development map at the European level. Greece is seen to be diverging from the European average. Secondly, crisis has impacted on the level of economic inter-regional development and inequalities within country. Regional inequalities, weighted by population, have been increased. Finally, the intensity and duration of the crisis has impacted on the intra-regional development and spatial inequalities within regions and cities. The high dispersion of unemployment generates social polarization and segregation across the country and within cities.



The results highlight the importance of well targeted interventions such as with public investment in order to make regions more resilience to crisis (OECD 2011b; OECD 2011c). The very inegalitarian spread of crisis impact questions horizontal policy measures and call for a more counter-cyclical and carefully targeted fiscal policy.

Geography proves to be a significant determinant for the gains from development and the losses from recession. The most urbanized and high income regions either on PATHE/NON-PATHE or North-South are more favorable in times of development and more vulnerable in times of economic crisis. Furthermore, the agricultural NON-PATHE regions are more vulnerable to crisis impacts as well as the southern areas of the country. Finally, NON-PATHE and SOUTHERN regions based on tourism are more vulnerable to crisis than PATHE and NORTHERN regions. If this holds true, it poses certain questions for the “right” mix of regional policy.

Another interesting empirical finding is that there are some significant differences between the determinants of regional development in the pre-crisis and during-the-crisis period; for example, the role of the agriculture sector and the level of economic prosperity of the regions. That implies that not only are specific regional policies needed for economic recovery, but that these policies should be closely monitored and adjusted during the different phases of the economic (business) cycle.

Policy interventions are important for regions as well as cities and large agglomerations. Nevertheless, we need to delve deeper and look into social groups and sectors of economic activity that are more vulnerable to crisis and therefore require interventions for social protection and economic development. As a result, policy-targeted interventions to ameliorate crisis impact and to find ways out of it have to be framed very carefully, and need to cover the functioning of economic policy at European, national and local levels.

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### CRISE ÉCONOMIQUE ET DÉVELOPPEMENT RÉGIONAL EN GRÈCE

**Résumé** - Cet article propose d'examiner les déterminants du développement régional en Grèce avant et pendant la crise économique. En proposant un modèle économétrique avec effets spatiaux pour les années 2005-2008 et 2009-2011, qui représentent respectivement les périodes de croissance et de dépression de l'économie grecque, nous cherchons à saisir les différents facteurs qui influent sur le développement économique régional des régions de niveau NUTS III. Les résultats montrent que les régions à niveau de revenu élevé et les plus urbanisées sont les plus affectées par la crise économique. La spécialisation dans les activités industrielles est un déterminant important du développement régional quelle que soit la conjoncture.

**Mots-clés** - CRISE ÉCONOMIQUE, RÉSILIENCE, DÉVELOPPEMENT RÉGIONAL, GRÈCE