Cultural Heritage led Growth: Regional evidence from Greece (1998-2016)

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January 2020

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January 2020

Abstract

This paper brings empirical evidence on the relationship between cultural heritage assets and economic growth. The case of Greece over the period 1998-2016 is taken as an example. Regional growth is approached through the formulation of a neoclassical growth model augmented with cultural heritage factors. Using panel methods of estimation, the empirical results reveal a positive impact of cultural heritage on regional growth, thus supporting a culture-led growth hypothesis for the Greek economy. In addition, a significant influence of other growth drivers such as physical and human capital, fertility and unemployment on regional growth is evidenced. Our results leave ample room for smart, inclusive and sustainable national, regional and EU policies to operate for the promotion of economic growth.

Key words: cultural heritage, regional growth, Greece

JEL classification: Z1, O47, P25

Acknowledgements

Thanks are due to Yolanda Totsiou for providing valuable insights into the cultural heritage and economic growth nexus; also to George Hondroyiannis for useful comments and suggestions. All errors and omissions remain ours.

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1. Introduction

Culture has for long been considered to have a beneficial impact on the economy. The influential works of Adam Smith (1761) analysed how norms, beliefs, morality and culture have affected economic development and Max Weber (1905) argued that religiosity has played a crucial role in the development of capitalism. In recent years there have been a great number of empirical studies analysing how culture affects economic development. Since culture is a broad, multidimensional and heterogeneous concept, the types of factors that have been used as proxies to assess its role in the economy vary between studies and make it difficult to come to easily comparable results (Marini, 2004).

A group of researchers (Hofstede, 1980; Hofstede and Bond, 1988; Franke et al., 1991) utilize cultural measures, such as individualism, masculinity, power distance and uncertainty avoidance, to evaluate the economic performance for various samples of nations. Their empirical analysis points to the potential of cultural determinants in explaining economic phenomena.

The important contributions of Putnam (1993) and Fukuyama (1995) clearly point to cultural factors as important, if not crucial, determinants of economic growth. Along these lines, a great number of studies come to the conclusion that high social capital, as reflected by indices such as trust, norm, civic cooperation, networks, community orientation and honesty, is beneficial to economic performance (Maridal et al., 2013; Akcomak and Weel, 2009; Ahlerup et al., 2009; Berggren et al., 2008; Beugelsdijk et al., 2004; Zack and Knack, 2007; Guiso et al., 2006; Whiteley, 2000; Knack and Keefer, 1997). However, there are studies with limited (Casey, 2004) or negative (Roth, 2009) support of this conclusion.

Other studies have found a significant relationship between measures of culture, economic freedom and economic growth (Johnson and Lenartowicz, 1998), showing that politics and enterprise culture, exert direct positive effects on the economy (Chatterji et al., 1993). Also, cultural factors together with the governmental ability to institute growth-oriented policies may determine the relative rates of economic growth (Gray, 1996). A number of researchers, having accepted the positive contribution of culture to economic growth, argue that cultural variables augment the explanatory power of the classic econometric model. They think that cultural variables must be treated as important causal variables and they incorporate cultural factors into formal behavioural models of economic growth and development (Altman, 2001; Granato et al., 1996).

In the European context, culture and in particular cultural heritage have been recognised as a European advantage and an engine to growth. Furthermore, education, innovation, training and continuing professional development are considered key elements for leveraging the valorisation of cultural heritage assets.

More specifically, in the *Maastricht Treaty* (1992)[1], culture is considered an advantage for the European Community that would "contribute to the flowering of the

[1] *European Communities* (1992, Article 151, ex Article 128).

cultures of the Member States, while respecting their national and regional diversity and at the same time bringing the common heritage to the fore". Furthermore, as was set out in the *Treaty of Lisbon* (2007)[2] the European Union was to become the most competitive and dynamic knowledge-based economy in the world, capable of sustainable economic growth with more and better jobs and greater social cohesion. In the framework of the Lisbon Strategy, the promotion of culture is an important driver for creativity innovation and competitiveness.[3]

Also, in the *European Agenda for Culture in a Globalizing World* (2007)[4] the strong link between culture and development is underlined. In the *New European Agenda for Culture* (2017)[5] it was decided the further strengthening of the cultural dimension of the European Union and the support of jobs and growth in the cultural and creative sectors. This would be carried out by promoting arts and culture in education, boosting relevant skills, and encouraging innovation in culture. In reaction to the economic crisis, the EU policy was further developed through the *Europe 2020* (2010) strategy, aiming at achieving smart, sustainable and inclusive growth, where the role of cultural heritage can be crucial in achieving these targets.[6] Dümcke and Gnedovsky (2013) provide evidence from several empirical studies, showing that the generation of knowledge and the development of educational and innovative products is an indispensable feature of the heritage sector (smart growth). In addition, cultural heritage has a great potential for skills development and also for the generation of direct and indirect jobs, thus fostering social cohesion (inclusive growth). Finally, cultural heritage contributes to sustainable growth through merging modernity and tradition and raises the profile of places making them more competitive.

The European Union therefore, is focusing on the positive contribution that culture makes to Europe's societies and economies and is committed to the promotion, restoration and conservation of cultural heritage. To this end it provides an operational framework through innovation (ICT actions) and education that acts as a catalyst for creativity. Cultural heritage refers to cultural capital stock, both tangible and intangible, that has been inherited from previous generations (Throsby, 2008). It is considered an asset like capital stock and acts as a driver to economic growth and development.

Furthermore, cultural heritage has to do with locality. Many empirical studies emphasise the regional aspect and there is a growing awareness that regions and cities may build their competitiveness by leveraging their cultural heritage (Scott, 1997; Sasaki, 2010; Bandarin et al., 2011; Licciardi and Amirtahmasebi, 2012). The promotion of localized cultural industries is considered important in generating opportunities for commercial initiatives, business expansion, and employment growth as well as providing increased incomes and widespread community benefits. The development of

[2] See, *European Union* (2007).

[3] For an evaluation of the relevant actions undertaken by the EU, see *European Union* (2018).

[4] See, *European Commission* (2007).

[5] See, *European Commission* (2018a, 2018b).

[6] In several of the *Europe 2020* flagship initiatives cultural heritage played already a vital role, such as the Digital Agenda, the Innovation Union or the Agenda for New Skills and Jobs (*European Commission*, 2010).

local economy through a higher cultural capital attracts creative people, making the production more efficient via higher technology (Beugelsdijk and van Schaik, 2005; Sasaki, 2010). Also, cultural heritage embodies the character of a specific area, thus highlighting the effort of the local policy-makers and institutions to develop programmes and policies in order to promote and preserve this heritage.

Cultural heritage is related to cultural tourism and offers a specific identity to tourist destinations and to visitors along with gastronomy and quality. Cultural heritage has been recognized as one of the most universal resources for creative tourism and can regarded as a passport to growth (Richards, 2002, 2007; Mackay and Fesenmaier, 2000; Lee and Chhabra, 2015). In addition, tourism brings new and fresh resources to the cultural sector, spotting new entrepreneurial opportunities, by boosting incomes and employment (Hampton, 2005; Alberti-Guisti, 2012; *UNWTO*, 2018).

The issue of cultural heritage as a growth factor is currently very important especially in the EU context. Although there is a great number of qualitative and case studies on the issue, formal empirical analysis is scarce. The purpose of this paper is to close this gap, bringing out empirically the role of cultural heritage as a driver to economic growth by using a formal econometric model. Thus, the impact of cultural heritage on the economy is captured via an empirical neoclassical growth model augmented with cultural variables. The analysis is carried out at regional level since cultural heritage assets have a strong local dimension.[7] The case of Greece (1998-2016) serves as an example for our empirical investigation since it is a country with important cultural heritage assets. Our model besides cultural heritage, accounts for other growth drivers such as physical and human capital and also labour specific variables such as fertility and unemployment.

The empirical results, based on GMM dynamic panel data analysis, have shown that cultural heritage is an important factor in explaining variations in per capita regional income in Greece. In addition, a significant influence of other growth factors such as physical and human capital, fertility and unemployment on regional growth is evidenced. Our results point to the need of further development and promotion of cultural heritage assets, especially in regions with less visited monuments. The conclusions drawn could be useful to regions and countries in order to upgrade their cultural heritage assets. Also, they leave ample room for regional, national and EU policies to operate for the enhancement of economic growth.

The rest of the paper is organised as follows. Section 2 presents particular features of the Greek economy which is investigated. Section 3 analyses the methodology and discusses the variables and data used. Section 4 presents the empirical results and finally, Section 5 concludes the issue.

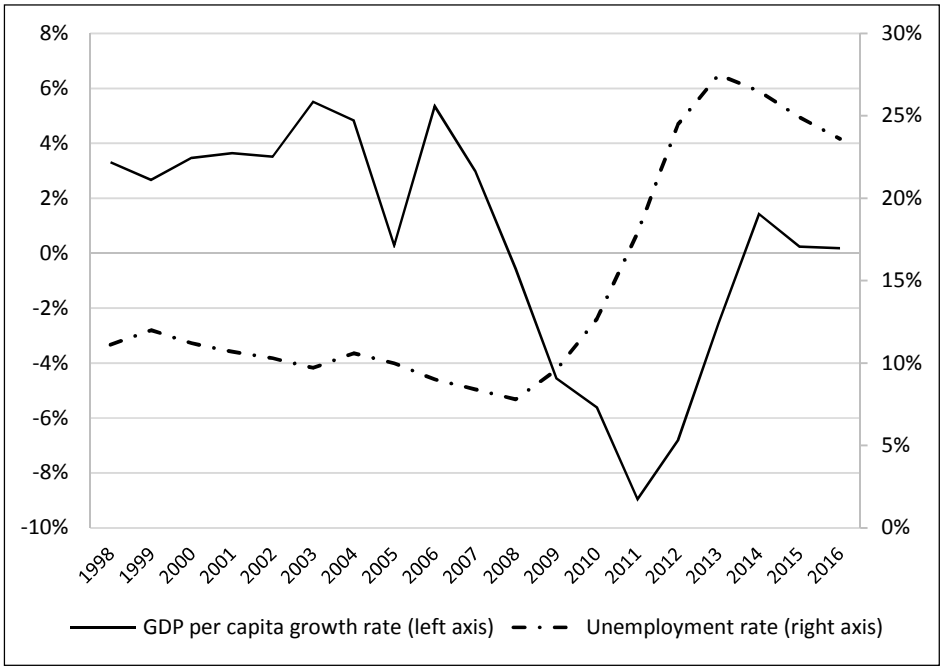
[7] The *thirteen* NUTS II regions of Greece are Eastern Macedonia-Thrace (Anatoliki Makedonia- Thraki), Central Macedonia (Kentriki Makedonia), Western Macedonia (Dytiki Makedonia), Thessaly (Thessalia), Epirus (Ipeiros), Ionian Islands (Ionia Nisia), Western Greece (Dytiki Ellada), Central Greece (Sterea Ellada), Attica (Attiki), Peloponnesus (Peloponnisos), Northern Aegean (Voreio Aigaio), Southern Aegean (Notio Aigaio) and Crete (Kriti).

2. Particular features of the Greek economy

In the period under review (1998-2016), the Greek economy has followed two different paths (Figure 1). Over the 1990s, in view of the country joining the Euro area, successful convergence programmes were implemented. As a result, from the mid 1990s till after the mid 2000s, the economy achieved high growth rates of around 4% per annum on average, well above those of the EU countries. Income growth was accompanied by regional convergence facilitated by the EU structural funds (Lolos, 2009). However, in the period 2007-09 there was a rapid deterioration of the internal and external balances of the Greek economy which almost coincided with the beginning of the global financial crisis (2008). In 2009, both the external imbalance and the public sector deficit rocketed to over 15% of GDP, while the public debt to GDP ratio increased to 127% from around 95% in the second half of the 1990s.

In 2010, the government, in order to avoid default, was obliged to enforce a severe structural adjustment programme which would turn into a series of adjustment programmes (2010, 2012, 2015) mainly financed by the EU countries (*European Commission*, 2018c; *IMF*, 2019). Various governments that came to office were thus obliged to implement severe austerity measures for fiscal consolidation, the achievement of external balance and competitiveness improvement, including tax increases and cuts in wages, pensions and salaries. As a result, the economic activity underwent an unprecedented depression, loosing around 25% of its output (2010-2017), while the rate of unemployment tripled to 28% relatively to previous periods (Figure 1). After 2017/8 the economy started recovering at low rates of less than 2% annually and unemployment dropped gradually to 18% in 2018.

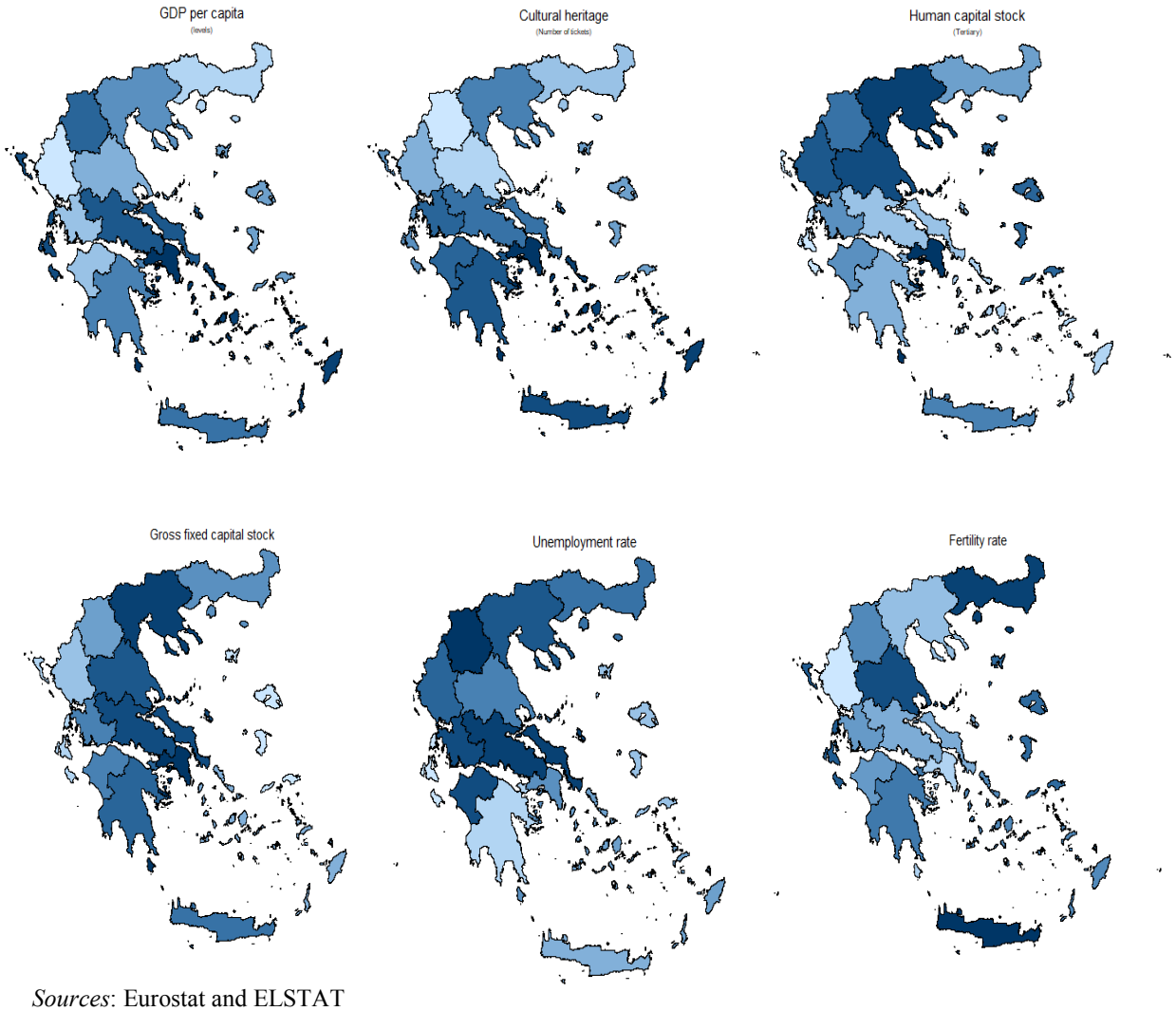
Figure 1: Real GDP per capita and unemployment rates in Greece (1998-2016)



Source: Eurostat

The Chart 1 bellow, presents the ranking of the Greek regions with respect to per capita value added (income) over the period 1998-2016. In *four* regions (Attica, Southern and Ionian Islands, Central Greece) the per capita income is above the country average, *two* regions (Crete, Western Macedonia) are close to the average and the remaining regions are lagging behind. The rate of unemployment is lower in the islands and Peloponnesus and more pronounced in Western Macedonia and Central Greece. The Chart 1 also presents the regional ranking of all variables used in the analysis of the Greek economy over the period 1998-2016.

Chart 1: Regional presentation of model variables (1998-2016)



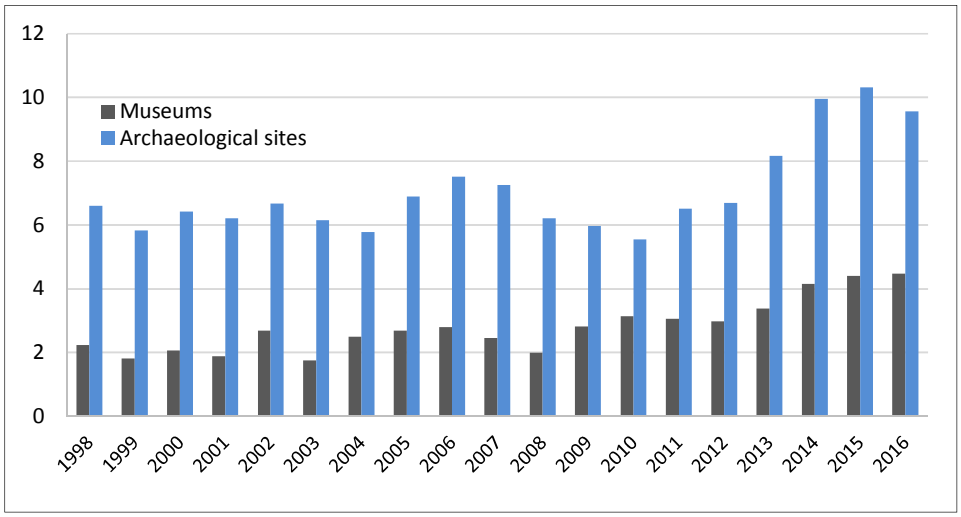
Sources: Eurostat and ELSTAT

One of the major challenges facing the Greek economy is the retardation of the long-run economic growth due to adverse demographic factors. Although in the first post-war decades the fertility rate -average number of births per woman- was of the highest among European countries (2.2-2.4), since the 1980s it has registered a long-term downward trend moving well below the critical value of 2.1 in 1981. Since the

1980s, fertility moved procyclically, registering small changes though. In particular, it declined over the 1980s and the 1990s (1999: 1.23) but it recovered somewhat in the period until the beginning of the economic crisis (2008: 1.5). During the contraction of the Greek economy, the fertility rate recorded a further decline (2013/15: 1.3). The fall in fertility, together with the phenomenon of "brain drain"[8] and the fact that Greece has not been the final destination of immigrants, has already lead to a population decrease in the country's ageing society.[9] These developments will affect adversely future employment, consumption, investment and the stability of the welfare state, and eventually the long-run potential of the economy, jeopardising the expected reduction of the high public debt ratio (187% of GDP in 2018).

Owing to its long standing history, a distinct feature of Greece is its very important cultural heritage endowment, like historical and archaeological sites, monuments and museums. The country's rich historical legacy is reflected in UNESCO's World Heritage List.[10] Over the period 1998-2016, the number of visitors to museums increased from 2.2 to 4.8 million people and in archaeological sites from 6.6 to 9.6 million people (Figure 2). This ascending trend, over the last decade reflects an expansion in "cultural tourism" and is also due to an increased number of museums and publicly accessible archaeological sites, including the launching of the flagship Acropolis Museum (2009). Note that the number of accessible to the public monuments has doubled over the period under examination (1998: 157, 2004: 182, 2010: 254, 2016: 303).[11]

Figure 2: Visitors to museums and archaeological sites in Greece (1998-2016), (Million tickets)



Source: ELSTAT

[8] Over the period 2008-2017 about 450,000, mostly highly skilled, young people emigrated to west European countries. For details, see *Bank of Greece* (2019).

[9] Note that according to the Eurostat the population in Greece decreased by 2.5‰ in 2016. For the relationship between the recent economic crisis and fertility, see Kotzamanis *et al*. (2017).

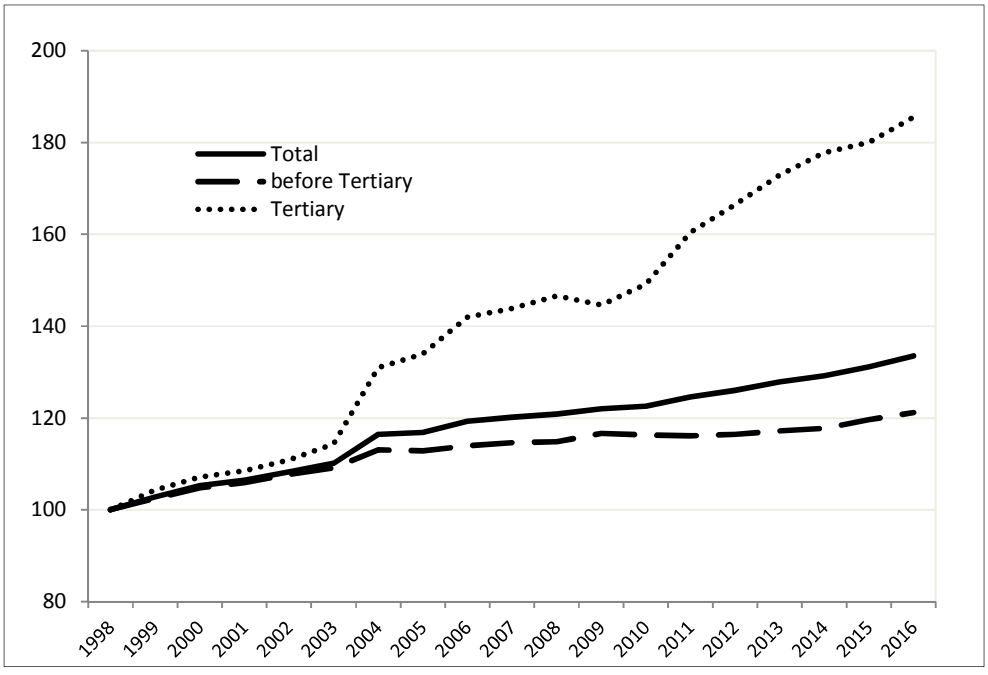
[10] For the list of monuments, see UNESCO (2018), https://whc.unesco.org/en/statesparties/gr

[11] See https://www.statistics.gr/en/statistics/-/publication/SCI21/- for the list of archaeological sites and museums in Greece.

The historical sites and museums are scattered across regions but the regional distribution of visitors is not uniform, depending on the historical importance of the various monuments, on the convenience of visiting them and also on the tourist attractiveness of the specific region. About half of the regions, mainly those where important *UNESCO* monuments are situated, attract the bulk of the visitors to historical sites and museums. In particular, over the period 1998-2016 Attica has attracted about 35% of total visitors to monuments in Greece and another *two* regions (South Aegean and Crete) have attracted around 17% of total visitors each (Chart 1). These top *three* regions are highly appreciated by about 70% of total visitors to monuments. They are followed by Peloponnesus with 12% and another *three* regions (Central Macedonia, Central and Western Greece) with about 5% visitors each, while the appeal of the remaining *six* regions (Eastern Macedonia-Thrace, Western Macedonia, Epirus, Ionian Islands, Thessaly and Northern Aegean) is lower but not negligible.

Note that, the ratio of the total number of visitors to historical sites and museums to the total number of tourist arrivals, amounts to 61% in Greece on average over the period 1998-2016. Therefore, besides the richness of historical monuments in Greece, it seems that, on average, less than half of the tourists visit historical monuments, since many tourists visit more than one monument. This figure compares unfavourably to around 100% in other European Mediterranean countries, which means that there is a great margin for an increase in visits. Note also that the regional distribution of the visitors/tourists ratio in *four* Greek regions (Attica, Peloponnesus, Western and Central Greece) is well above the country's average (80-120%) and in *three* regions (Northern and Southern Aegean, Crete) it is close to average (60%). In the remaining regions the ratio is quite low (less than 20%), which means that in those regions the number of visitors can be increased substantially if local monuments are adequately promoted.

Figure 3: Human capital stock categories in Greece (1998-2016), 1998=100

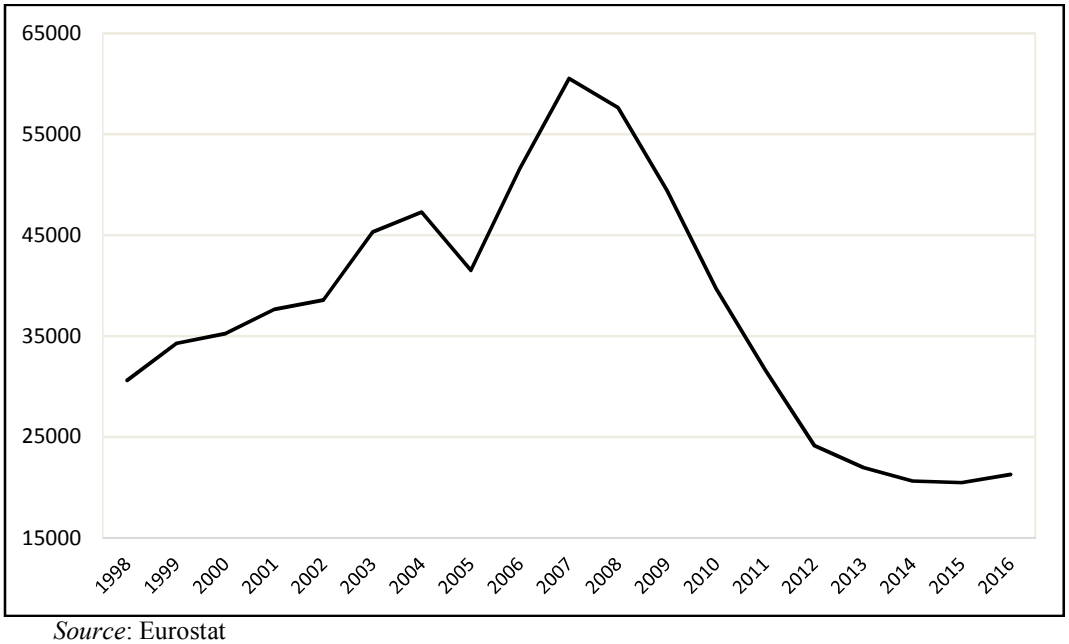


Source: ELSTAT

The development of different measures of human capital stock is presented in Figure 3, above. In our analysis, human capital stock in a region is defined as the ratio of the number of people with education -measured by the years of schooling- to total labour force. We used three measures of human capital stock: total human capital stock (total number of people with education over total labour force); tertiary human capital stock (number of people with higher education over total labour force); and before tertiary human capital stock (number of people with before tertiary education over total labour force).[12] Over the period 1998-2016 all three measures are on an ascending trend, with the higher education category growing faster (around 10% annually). The distribution of total human capital stock across regions is quite even (around 8% each), while higher education is somewhat more pronounced in the two central regions (Chart 1).

Regarding the development of physical capital stock which is an important driver to economic growth, it follows the path of real per capita income. We observe an upward trend over the period 1998-2007 when the economy was growing being attributed to increased construction, infrastructure and business investment along with a high absorption of European structural funding. There follows a descending path thereafter, in line with the falling economic activity and an abrupt drop in investment (Figure 4). The regional distribution of physical capital stock reveals the centre/periphery dichotomy in Greece, where in two central regions (Attica and Central Macedonia) it is invested about 50% of the country's capital stock, with the rest of the regions receiving around 5% of the total each (Chart 1).

Figure 4: Physical capital stock in Greece (1998-2016), in million Euros



Source: Eurostat

[12] See next section for a formal definition of these variables.

3. The model, data and methodology

Economic theory and especially neoclassical models usually incorporate only strictly economic variables such as capital stock, technological change and human capital in their analyses. Following the discussion of Section 1 above, if the role of culture in economic performance is assumed away there is a danger of a misleading solution (Gray, 1996). Thus, an empirical model that incorporates both cultural and economic variables is superior to an explanation emphasizing on one set of these variables.

The point of departure of our empirical analysis is a neoclassical growth model that incorporates cultural factors as independent and causally substantive variables with respect to economic growth and development. Also, our analysis controls for factors commonly recognized in the economic growth literature. The model is dynamic and incorporates region specific variables as follows:

$$y_{i,t} = f(y_{i,t-1}, x_{i,t}) \qquad (1)$$

where $y_{i,t}$ is the income of region i in period t and $x_{i,t}$ is the array of explanatory variables of regional income including a cultural heritage variable. The selection of variables is based on existing evidence of the factors affecting regional growth, also accounting for growth drivers in line with the Europe 2020 strategy. In particular, we assume that economic growth is smart (related to education, knowledge and innovation), inclusive (with high-employment, social and regional cohesion) and sustainable (resource-efficient and competitive).

The explanatory variables included in the empirical model are the following:

(i) Lagged income

In dynamic panel estimations, we should instrument the potential endogenous variables. This is done, using the lagged dependent variable and the appropriate lags as instruments of the variables. Thus, following common practice, we have used a lagged dependent variable to explain regional income on the grounds that regional income is highly correlated in time and it usually changes by small amounts. The inclusion of the lagged dependent variable gives us an indication of the speed of adjustment of income and the long-run impact of the independent variables.

(ii) Cultural heritage

Cultural heritage refers to cultural capital assets, both tangible (historical sites, monuments, museums etc) and intangible (cultural events, festivals, etc) that has been inherited by previous generations (Throsby, 2008). A number of empirical studies support that cultural heritage has a direct and positive impact on regional economic growth, since a country or region with a large stock of cultural heritage has an advantage over others with a smaller stock of cultural heritage.

In particular, Faria and León-Ledesma (2003), using UNESCO's list of monuments as a proxy for cultural capital stock for a set of countries, found that a country with a higher cultural heritage share grows faster; strongly supporting the hypothesis that cultural heritage has a positive and significant impact on economic growth. Similarly, Saccone and Bertacchini (2011), using UNESCO's World Heritage Sites for a panel of 131 countries over the period 1978-2007, found that economic size

and participation to the World heritage system are positively related; and the promotion and preservation actions of cultural heritage may create development oppotunities. Bowitz and Ibenholt (2009) assess the impact of cultural heritage on employment and find that tourism related to cultural heritage is directly and indirectly responsible for the 7% of the workforce in the Norwegian city of Røros. Also, Doulgeraki (2018) investigated the impact of cultural heritage -in terms of number of visitors to monuments- on economic growth in Greece over the period 1970-2015 and found a strong impact of cultural heritage on economic growth.

In our analysis we employ the annual number of visits (tickets sold to museums and archaeological sites) as an indicator reflecting the use value of tangible cultural heritage (Throsby, 2012). Intangible cultural heritage, such as handicrafts, gastronomy, festivals, music, oral traditions and other cultural events, are considered to be almost as important but because of lack of data, their use value is not been accounted for. Our cultural heritage variable captures the development of cultural heritage use value over time.[13] The number of visits to a monument is an indication of its importance and its cultural value and is related to spending, value added and employment. An increase in visits in a region may be due to a better promotion policy of the monuments to attract more visitors or to the addition of new monuments. Our proxy for cultural heritage is not a static variable since it accounts for the development of cultural heritage value and incorporates the demand and supply sides of cultural heritage. This variable is expected to affect income positively.

(iii) Human capital

The role of human capital as an important driver to economic growth is well documented in the literature. See, *inter alia*, Barro, 1991; Barro and Sala-i-Martin, 2004; Baumol, 1986; Lee and Lee, 1995; Levine and Renelt, 1992; also, the reviews by Temple (1999) and Benos and Zotou (2014). Human capital refers to the stock of knowledge and health embodied in labour force and it is a very important component of social development since it can be accumulated, it might have positive externalities and it can be quantified (Becker 1964; Schultz, 1961). The new growth theory models of Romer (1989; 1990) and Lucas (1988) use either educational quality or quantity as major factors of economic development. The improvement of human capital and the accumulation of new knowledge and skills create new entrepreneurial tasks and business opportunities which have a positive effect on productivity and economic success (Becker et al., 1990; Hunter, 1986; Shane and Venkatraman, 2000). These effects could apply to the whole economy and also to specific sectors, e.g. the tourist sector (Rey-Maquieira et al., 2006). Furthermore, the development and promotion of cultural heritage assets requires skills that are not always available locally since qualified people are not equally distributed in geographic space. In the case of Greece, as in the majority of empirical studies in the literature, it is found a positive long-term relationship between human capital and economic growth (Caramanis and Ioannides, 1980; Psacharopoulos, 1982; Psacharopoulos and Kazamias, 1985; Asteriou and Agiomirianakis, 2001; Benos and Karagiannis 2008; Pegkas and Tsamadias, 2014).

[13] Furthermore, people derive value from having the option to visit a heritage monument even if they never do ('non-use value').

From an empirical point of view, testing the relationship between education and economic growth is faced with issues of human capital measurement and many recent studies use international data of schooling quality such as tests scores, pupils-teacher ratio, expenditure on education, years of education, etc. In our paper, three alternative measures of human capital are used. The first measure is total human capital stock ($HumCap_{tot}$) based on the average years of schooling and it is considered a better measure than the school enrolment rate or the student-teacher ratio (Chi, 2008). The years of schooling of the different educational levels in Greece (Elementary school, Gymnasium, Lyceum, University degree and over) are cumulatively 6, 9, 12 and 16 years respectively. So, the total human capital stock for each region is defined as follows:

$$HumCapTot = \frac{(6*H_6+9*H_9+12*H_{12}+16*H_{16})}{Labour} \quad (6)$$

where H_n refers to the number of persons with n schooling years and $Labour$ is the labour force. Furthermore, total human capital stock is decomposed into *two* different variables with respect to the educational level, following the Zhang and Zhuang (2011) methodology, namely the *tertiary* level (higher education) denoted by $HumCapTer$, and the *before tertiary* level (primary and secondary education) denoted by $HumCapBeTer$, as follows:

$$HumCapTer = 16 * \frac{H_{16}}{Labour} \quad (7)$$

$$HumCapBeTer = \frac{6*H_6+9*H_9+12*H_{12}}{Labour} \quad (8)$$

All proxies for human capital stock are expected to have a positive impact on the development of regional income.

(iv) Physical capital

Based on the neo-classical model, gross fixed capital formation is an important growth factor that reflects investment in capital accumulation, technological innovations and advancements that play a key role in the growth process (Abreu, 2019; Audretsch, 2009; Acs and Audretsch, 1988) while country differences in economic performance are associated with different investment rates (O'Mahony and de Boer, 2002). In the case of Greece several empirical studies have highlighted the role of physical capital on economic growth and found that physical capital exerts a strong positive impact on output (Liargovas and Repousis, 2015; Louri and Anagnostaki, 1995; Fotopoulos and Spence, 1988).

(v) Fertility rate

The assumption of an immobile economy implying that factors of productions are stable across time and economies is unrealistic. Population changes and economic growth are interrelated and demographic factors affect economic development (Lee and Mason, 2001; Deardorff, 1976; Tobin, 1967). In our study we allow for population changes to affect endogenously economic growth (Becker, 1973). We also assume that fertility affects the economy by influencing labour and capital accumulation. At present, the Greek economy has to a great extent overcome the adverse economic and social

situation of the recent past but is faced with a greater problem which has appeared over the last decades. There has been a drop in the birth rate which increases the possibility of weakening growth of population and economic contraction in the years to come. To account for this effect we included fertility in the explanatory variables of the model, defined as the average number of births per woman, as a proxy to the growth rate of population (Hondroyiannis, 2004; Hondroyiannis *et al*., 2002). It depicts the potential of population change and is expected to have a positive impact on income.

(vi) Unemployment rate

The rate of regional unemployment is included in the model in order to capture an "Okun's law" type of a growth-unemployment trade off at regional level. Thus, an inverse impact of regional unemployment on income is expected, highlighting the fact that increased unemployment is related to lower output. The unemployment variable in the relationship reflects the existence of an aggregate supply curve and from an empirical perspective the unemployment coefficient offers a tool for policymaking. Note that Okun's Law (1962) is verified empirically at regional level in the case of Greece (Apergis and Rezitis, 2003; Christopoulos, 2004). The relationship of regional unemployment with real sector developments is also investigated empirically by Lolos and Papapetrou (2012).

In view of the above presented discussion, we estimate a regional income equation using annual data for Greek regions over the period 1998-2016.[14] To investigate the behaviour of regional economic growth a Arellano-Bover/Blundell-Bond linear dynamic panel estimator was employed, based on the fact that (a) there exists a dynamic linear functional relationship, (b) variables are not strictly exogenous (c) there is unobserved heterogeneity (d) there is possible heteroskedasticity and autocorrelation within individual units' errors. More specifically, the following model is considered:

$$lnY_{i,t} = a_0 + \beta\left(lnY_{i,t-1}\right) + \gamma_1\left(lnCulHer_{i,t}\right) + \gamma_2\left(HumCap_{i,t}\right) + \gamma_3\left(lnPhyCap_{i,t}\right) + \gamma_4\left(Fertil_{i,t}\right) + \gamma_5\left(lnUnempl_{i,t}\right) + a_i + \varepsilon_{i,t}$$

$$\text{for } t = 1998, \dots, 2016 \text{ and } i = 1, 2, \dots, 12 \qquad (9)$$

The dependent variable $lnY_{i,t}$ is the natural logarithm of gross per capita value added in region *i* at time *t* calculated at 2010 prices. The first regressor $lnY_{i,t-1}$ is the lagged dependent variable that accounts for possible autocorrelation and gives an estimate of the speed of regional income adjustment.

The next five regressors, $lnCulHer_{i,t}$ $HumCap_{i,t}$, $lnPhyCap_{i,t}$, $Fertil_{i,t}$ and $Unempl_{i,t}$ are the region specific variables. The variable $lnCulHer_{i,t}$ is the natural logarithm of the number of visitors (tickets) to archaeological sites and museums of region *i* at year *t*. The variable $HumCap_{i,t}$ is human capital stock defined as the ratio of the average years of schooling of all people in region *i* at year *t* over total labour force in the region. In the empirical analysis this variable was decomposed into the three aforementioned alternative measures ($HumCapTot_{i,t}$, $HumCapTer_{i,t}$ and $HumCapBeTer_{i,t}$). The variable $lnPhyCap_{i,t}$ is the natural logarithm of physical capital

[14] In the econometric analysis the region of Western Macedonia is excluded due to missing data in some variables.

stock of region i at year t. The variable $Fertil_{i,t}$ is defined as the average number of births over female population and the variable $lnUnempl_{i,t}$ is the natural logarithm of unemployment level of region i at year t.[15]

Finally, α_i is the fixed effect term and ε_{it} is an error term which it is assumed to have a mean of zero, to be independently distributed over all i and t and to account for size and other differences between the regions, to be heteroskedastic over i, namely $\text{var}(\varepsilon_{it}) = \sigma_i^2, i = 1,...,13.$

The Arellano-Bover/Blundell-Bond system estimator used in our analysis outperforms other GMM estimators. It has the advantage that, compared to the difference GMM estimator for dynamic panel data models, it avoids a substantial finite-sample bias due to weak instruments that can lead to mispecified confidence intervals. Furthermore, in addition to the moment conditions of lagged levels as instruments, it employs additional moment conditions in which lagged differences are used as instruments for the level equation (Roodman 2009a, 2009b). The moment conditions are valid only if there is no serial correlation in the idiosyncratic errors.[16]

The second step of the analysis is the investigation of the short-run Granger causality between certain variables. However, it has to be initially determined whether the series have any integration orders employing panel unit root tests. In order to detect in advance the stationary properties of the variables, they should be further elaborated in order to use the appropriate panel unit root tests. If the panel time-series data is not cross-sectionally independent and homogenous, the conventional panel unit root tests (IPS, LLC, HT and Hadri) produce inconsistent results. High degrees of interrelation between cross-units might give rise to the existence of this problem. Thus, it is important to test the existence of cross-sectional dependence before any econometric elaboration. Pesaran (2004) has proposed a cross-sectional dependency (CD) test. Under its null hypothesis of no cross-sectional dependence, the Pesaran's CD test statistic that is used in the present study is as follows:

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\widehat{p_{ij}}\right) \qquad (10)$$

where T is the time interval, N is the number of cross-section units, and p_{ij} is the pair-wise correlation between cross-sections.

Next, for the purpose of using panel unit root tests robust to the issues of CD and HTR, the CADF and the CIPS unit root tests were employed. These tests produce consistent and reliable results in the presence of both HTR and CD. Furthermore, to address the cross-sectional dependence and heterogeneity issues, the panel Granger causality test developed by Dumitrescu and Hurlin (2012) was employed. Dumitrescu

[15] Data for value added, physical capital stock, fertility, population and unemployment is taken from the Eurostat database. Data for the number of visitors to museums and archaeological sites and the variables to calculate human capital stock are drawn from the Hellenic Statistical Authority (ELSTAT). Population and employment variables refer to the segment between 15-64 years of age.

[16] We are only concerned with second and higher order autocorrelation. The Arellano-Bond test for serial autocorrelation does not reject the null of no second-order serial correlation, implying that the moment conditions are valid, and presents no evidence of model misspecification.

and Hurlin's (2012) proposed a panel causality test that is based on the individual Wald statistic of Granger non-causality averaged across the cross-section units. The testing procedure takes into consideration the existence of heterogeneity of causal relationships and the heterogeneity of the regression model. The linear panel regression model is as follows:

$$y_{it} = a_i + \sum_{j=1}^{J} b_i^j \, y_{i,t-j} + \sum_{j=1}^{J} c_i^j x_{i,t-j} + e_{i,t} \qquad (11)$$

where y is real per capita income and x is the vector independent variables. The null hypothesis of this specific test is the non-causal relationship for any of the cross-section units against the alternative hypothesis that causal relationships occur for at least one subgroup of the panel. Rejection of the null hypothesis indicates that x Granger causes y for all i regions. Thus, the average of the individual Wald statistic generated by Dumitrescu and Hurlin (2012) assumes the following:

$$W_{N,T}^{Hnc} = \frac{1}{N} \sum_{i=1}^{N} W_{i,t} \qquad (12)$$

where $W_{i,T}$ is the individual Wald statistic for the i-th cross-section region.

4. Empirical findings

First, we apply the cross-section independence test (CD-Pesaran) to data for income, cultural heritage, human capital, physical capital, fertility and unemployment so as to reveal the characteristic of error terms across sample regions. Test statistics from the Pesaran's test reported in Table 1 show that the panel time-series data have cross-sectional dependence (CD). Overall, we pin down the presence of CD and HTR across the Greek regions for the investigated variables.

Table 1: Results from cross-section independence test

	Statistic	p-value
Per capita income	32.51	0.00
Cultural heritage	14.58	0.00
Human capital stock (total)	33.92	0.00
Human capital tertiary stock	31.87	0.00
Human capital before tertiary stock	21.03	0.00
Physical capital	31.08	0.00
Fertility rate	25.74	0.00
Unemployment	32.39	0.00

Notes: This test assumes the null hypothesis of cross-section independence.

In the case of existence of CD and HTR the CADF and CIPS unit root tests should be used in order to obtain consistent and reliable results. According to output given in Table 2, results in levels are mixed while all variables become stationary at their first differences at 1% significance level.

The results of our estimations are presented in Table 3, below. Almost all coefficients are highly statistically significant and they all have the expected sign, while their magnitude varies slightly across the three empirical models. Furthermore, the estimated models pass the robustness tests of over-specification and serial correlation. More specifically, the consistency of the GMM estimator depends mainly on the

absence of second-order serial correlation in the errors and the validity of the used instruments. As we can see, both the Sargan test and the second order serial correlation test fail to reject their null hypotheses implying that the tests give further support to the estimated models and its implications.

Table 2: Panel unit root tests

	CIPS		CADF	
	Level	Δ	Level	Δ
Per capita income	-2.654	-4.339***	-2.502	-2.700***
Cultural heritage	-2.953**	-4.836***	-2.578	-3.587***
Human capital stock (total)	-2.775	-4.063***	-2.590	-3.062***
Human capital tertiary stock	-2.128	-3.627***	-2.300	-3.328***
Human capital before tertiary stock	-3.358***	-4.443***	-3.132***	-3.682***
Physical capital	-2.971**	-4.457***	-3.304***	-3.654***
Fertility rate	-3.221***	-5.038***	-2.802**	-3.534***
Unemployment	-3.253***	-4.495***	-3.116***	-3.798***

Notes: The symbols (**) and (***) indicate rejection of the null hypothesis at the 5%, and 1% levels of significance, respectively. Δ is the first-difference operator.

Table 3: Results from GMM estimation procedure

Variables	Model 1	Model 2	Model 3
Lag of dependent variable	0.890*** (37.18)	0.891*** (43.23)	0.872*** (41.48)
Cultural Heritage	0.013*** (4.15)	0.010*** (3.73)	0.011*** (3.80)
Human capital stock (total)	0.011** (2.10)	-	-
Human capital tertiary stock	-	0.025*** (3.22)	0.020*** (2.71)
Human capital before tertiary stock	-	0.006 (1.12)	-
Physical capital stock	0.067*** (7.12)	0.068*** (7.67)	0.073*** (8.21)
Fertility	0.087*** (2.82)	0.097*** (3.19)	0.102*** (3.36)
Unemployment	-0.099*** (-9.35)	-0.096*** (-9.41)	-0.098*** (-9.43)
Constant	1.090*** (5.95)	1.062*** (6.55)	1.233*** (7.37)
Serial correlation test[a]			
First order (p-value)	0.003	0.002	0.002
Second order (p-value)	0.481	0.421	0.189
Overidentifying restrictions[b]			
Sargan test (p-value)	0.184	0.135	0.127
Observations	216	216	216

Notes: The symbols (**) and (***) indicate rejection of the null hypothesis at the 5% and 1% levels of significance, respectively. Z-statistics are reported in parentheses. ([a]) The null hypothesis indicates that the errors in the first-differenced regression exhibit no first and second order serial correlation respectively. ([b]) The null hypothesis indicates that overidentifying restrictions are valid and the instruments are correctly determined.

An important finding of our investigation is that cultural heritage led hypothesis is empirically verified since cultural heritage has a positive and statistically significant impact on regional income. The elasticity of per capita income with respect to cultural heritage ranges from 0.010 to 0.013 and the long-run elasticity is about 0.116 indicating that a 10% increase in visits to monuments may lead to an increase in per capita income by around 1.2 percentage points. Similar results were found by Doulgeraki (2018) in a time series analysis for the case of Greece. It is worth noting that over the period 2010-2015, which has been marked by the sharp economic downturn of the Greek economy, the number of visitors to historical monuments increased by 20%, which, according to our model, might have affected the income per capita by around 2.4 percentage points.

Furthermore, our analysis incorporates by definition only the effect of tangible cultural heritage assets. Intangible cultural events are not accounted for because of non-availability of data. We know that many established events (e.g. the Athens & Epidaurus Festival, Patras Festival, Sani Festival, Philippi Festival) take place in the summer period along with a great number of *ad hoc* smaller cultural events (local theatre performances, concerts, dancing festivals, exhibitions, cine festivals, etc) all over Greece, especially in the periphery. Unfortunately, we do not have sufficient knowledge of the attention these events draw but it might not be far from reality if we assume that the impact of intangible cultural events on the economy is comparable to that of tangible cultural heritage. We can thus infer that the magnitude of the total effect of cultural heritage on income may well be about twice the estimated one.

Human capital is another important driver for growth. The coefficient of total human capital stock measured as the ratio of the number of total years of schooling of all people in a region to total labour force (Model 1) is 0.011 (at 1% significance level) meaning that a 10% increase in the number of people with all educational levels will rise per capita income by 0.1%. However, when the human capital stock is separated into two educational levels -tertiary and before tertiary- in order to investigate the contribution of each educational level to the development of income (Model 2), only the tertiary educational level has a positive and significant impact on the economy. The coefficient of human capital tertiary stock (people with higher education) is 0.025 while that of the before tertiary (people with primary and secondary education) is statistical insignificant. Furthermore, Model 3 includes only tertiary human capital stock and the results are very similar to the previous models. These results are in accordance with those of prior studies (see for example Petrakis and Stamatakis, 2002). The long-run effect of human capital stock is much larger ranging from 0.10 to 0.23 that highlights the substantial impact of education on economic growth.

In addition, a positive and very substantial impact of physical capital stock on per capita income is found in all models, as expected. The elasticity of physical capital is around 0.07, a result similar to Liargovas and Repousis (2015) findings. The importance of private and public investment is borne out by our results, given that 50% of the European structural funding goes to infrastructure investment. On the other hand, the coefficient of fertility is positive and statistically significant with a magnitude close to 0.09 in the three models. This means that a drop in the fertility rate by 1% will decrease per capita income by 0.09 percentage points. Also, according to our results, the level of unemployment has an expected negative and statistically significant impact on per capita

income with a coefficient of around 0.09. Thus, an unemployment-income trade off is verified by our results, a finding similar to Christopoulos (2004) and Lolos and Papapetrou (2012).

It is also noteworthy to indicate that according to our results, the coefficient of the lagged dependent variable is 0.89 indicating a high speed of adjustment of per capita income to equilibrium. It measures how strongly per capita income reacts to a deviation from the equilibrium relationship in one period.

Finally, in our paper we estimated empirically short-term causal relationships between the growth drivers of our model and real income. The results at country and at regional level are presented in Table 4. At national level, our results indicate that there is statistically significant short-run feedback causality between cultural heritage and per capita income. In the case of human and physical capital statistically significant one-way causality to real income is detected. At regional level, the strength and the direction of causality of the various variables is mixed, depending on the specificities of each region.

Table 4: Results from Emirmahmutoglu-Kose Granger short-run causality tests

Regions	between Cultural Heritage & Income		between Total Human Capital & Income		between Physical Capital & Income	
	Wald	*Decision*	Wald	*Decision*	Wald	*Decision*
Greece	4.809*** 2.487**	↔	5.756*** 0.640	→	3.448*** 1.926	→
East Macedonia-Thrace	0.851 0.521	-	6.780** 0.014	→	10.676*** 0.365	→
Central Macedonia	0.475 2.756	-	5.363** 0.744	→	12.555*** 1.179	→
Epirus	3.503* 6.212***	↔	8.540** 1.829	→	5.532** 10.975***	↔
Thessaly	1.747 2.875	-	7.348** 0.031	→	1.770 0.016	-
Ionian Islands	0.114 0.230	-	1.810 0.854	-	0.378 0.692	-
Western Greece	0.397 0.096	-	7.154** 0.043	→	1.025 0.152	-
Central Greece	8.880*** 0.365	→	6.631** 1.686	→	0.241 2.563	-
Attica	6.382** 0.209	→	2.682 0.598	-	2.935* 1.588	→
Peloponnesus	9.586*** 4.077*	↔	6.985** 0.419	→	2.012 0.002	-
Northern Aegean	10.720*** 0.064	→	10.147*** 0.270	→	3.756* 0.040	→
Southern Aegean	1.001 4.181*	←	1.200 0.773	-	0.106 2.270	-
Crete	14.952*** 9.262**	↔	4.437* 0.418	→	0.387 3.274*	←

Notes: The symbols (*), (**), and (***) indicate rejection of the null hypothesis at the 10%, 5%, and 1% levels of significance, respectively. Note that Western Macedonia is not included in the estimations.

In particular, in the case of the short-run Granger relationship between cultural heritage and per capita income, a statistically significant causality is detected in more than half of the regions (*seven*), among them *three* regions (Attica, Southern Aegean and Crete) with the highest share in cultural heritage demand in Greece (about 70% of the total). In the rest of the regions no statistically significant causality is observed.

Regarding the short-run link between total human capital stock and per capita income, a statistically significant one-way causality from human capital to income is detected in the majority (*nine*) of Greek regions. Only in *three* regions short-run causality was statistically insignificant. Finally, physical capital short-run causality is detected in half (*six*) of the regions under investigation.

5. Conclusions

In this paper we investigated the role of cultural heritage in the determination of economic activity. This has been carried out by estimating a dynamic neoclassical empirical growth model augmented with a cultural heritage variable. We investigated the case of Greece since it is a country with important cultural heritage assets. Our model also accounts for other growth drivers such as physical and human capital and labour specific variables such as fertility and unemployment. The analysis is carried out at regional level since cultural heritage assets have a strong local dimension. We used a GMM estimation methodology with annual data for the period 1998-2016.

Our empirical results showed the existence of a long-term equilibrium relationship between cultural heritage and economic growth in Greece. Cultural heritage is a positive catalyst for economic growth, confirming the culture-led growth hypothesis. Our results also indicate that both human and physical capital and population growth have an important positive effect on income. Unemployment is negatively related to income, while the speed of adjustment to equilibrium income is quite fast. In addition, we investigated the short-run causality between real income and the growth drivers using a panel Granger causality test. Our results showed the existence of feedback causality between cultural heritage and income and also a one-way causality from human and physical capital to real income. Overall, our findings are in line with the aim of the Europe 2020 strategy at achieving smart, inclusive and sustainable growth.

Our findings suggest that regional economic performance in Greece can be substantially boosted if cultural heritage is further developed and promoted, given that the ratio of the number of visitors to monuments to the number of tourists is around 60% of the south-European average. This ratio is around 20% in almost half of the Greek regions, signifying that there is ample room for improvement. This calls for the formulation of a coherent set of specific actions for the promotion and development of cultural heritage with priority to less visited historical monuments.

These actions involve the promotion of monuments with the dissemination of information (tourist guides, leaflets), the highlighting of local myths, legends and the human presence over the centuries (habitation, land exploitation, art and industrial activities, food production and nutrition). These actions should be also carried out using Information and Communication Technologies - ICT (creation of digital environments,

websites, computer apps and videos, participation in social media, online information, digital presentation of collections, e-tickets etc).

However, the design and implementation of these measures require specific and high quality skills (multilingual guides, historians, archaeologists, professional managers, computer experts, etc) that are not generally available at regional or local level since qualified people seek for employment opportunities in the central peripheries. The promotion and development of cultural heritage may act as a catalyst for challenging regions to create of a proper environment that would attract high level human capital. The acquisition of heritage-related skills will upgrade traditional professions and will boost research and innovation setting up competitive businesses.

In addition, tourist policy, by shifting the emphasis from "Sea and Sun" towards "Sea, Sun and Culture" destinations, will increase the inflow of tourism to less visited monuments and regions by awarding them a local identity that will be further enhanced if connected to gastronomy and quality. These initiatives would expand the tourist period, boost employment and incomes and launch new investment, thus enhancing regional competitiveness, productive capacity and wellbeing.

Reforms are also required regarding the operational framework of the public authorities that are responsible for all aspects of cultural heritage. In today's complex and competitive environment, the aforementioned actions will be fulfilled more efficiently if there is dear collaboration with the private sector, together with decentralization of decision and policy making. Thus, the public authorities should definitely keep their supervisory role but the design and implementation of cultural heritage policies will be greatly facilitated by public-private partnership initiatives in collaboration with the regional governments. Furthermore, in order to activate the important synergies among culture, tourism, education and gastronomy, there should be an interactive cohabitation within all public authorities involved.

Note finally, that according to our empirical results, regional economic growth will be greatly benefited if policies are pursued in boosting physical capital, combating unemployment and reversing the downward trend of fertility.

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