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Impact of Intangible Cultural Capital on Regional Economic Development: A Study on Culture-Based Development in Greece

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Abstract: The main aim of the paper is to explore the nature and consequences of intangible cultural capital, i.e., the local 'milieu' comprising inter alia attitudes and preferences, for the case study of Greece, 2002-2009. To pursue this study empirically, we combine basic economic and social indicators from two main sources: the EUROSTAT Regional Database and the European Social Survey (ESS). Employing a three-stage least squares (3SLS) model for both a normal and a pooled cross-sectional data set, we find that local cultural factors play an important role in the emergence and existence of spatial economic disparities in Greece. Most interestingly, among all the approximations of intangible cultural capital examined, the historical cultural variable appeared to show the most consistent results throughout all specifications. This suggests the existence of cultural persistence traits in local economic development in Greece, a phenomenon which merits further investigation.

1. Introduction

In the conceptualisation of culture, a broadly accepted distinction is that between tangible (material) and intangible (immaterial) culture. However, as far as culture – and its position in Greece – is concerned, the discourse has mostly developed along the nexus of tangible cultural capital[1], in particular of cultural heritage utilized for the development of tourism (see, for example, Coccossis and Psycharis, 2008; Konsola and Karachalis, 2010). The intangible local cultural capital effect in Greece remains largely unexplored in that country. This is, however, not the case for many other European countries nor for the USA and even Africa. In fact, intangible local cultural capital has been documented to have a strong relationship with local socio-economic development in many other places worldwide. Therefore, our aim is to address the impact of intangible local cultural capital in Greece.

Studies on the impact of intangible local cultural capital have been numerous and mirror long-lasting

[1] Originally, the definition of cultural capital - both tangible (e.g., cultural objects) and intangible, (e.g., attitudes and beliefs) - was introduced on the individual level by Bourdieu (Bourdieu, 1986). Bourdieu explains class reproduction that offsets true individual-merit-based development in France. From the empirical work on cultural capital (both tangible and intangible) has emerged the culture and education strand of the literature (Di Maggio, 1982; De Graaf, 1986; De Graaf et al., 2000); Bourdieu's concept can be traced in the literature related to path dependence (Sen, 2000; Page, 2006). However, the idea of the effect of attitudes and beliefs on welfare at the aggregate level - though not termed 'cultural capital' - was developed much earlier in scientific thinking. Starting with Max Weber's research on the role of attitudes (approximated with religious beliefs) in Germany (Weber, 1905), this strand of the literature has been advanced by Barro and McCleary's research (2003, 2005) on the impact of religion on local development (for an overview, see Becker and Woessmann, 2007).

explorations (for a substantial overview, see Guiso et al., 2006). Recent empirical investigations on the regional or local level mainly concern trade or finance (FDI). In this context, home bias is a reductionist measurement, originating in the proxy-motivated notion of culture as an input in trade. The related findings touch on both the Balassa-Samuelson effect on types of goods traded (Samuelson, 1994) and the financial investment decisions across countries (see Bowen, 1980; Lucey and Zhang, 2010). In recent decades the role of local culture in knowledge and entrepreneurial clustering has also been put forward (see Giese, 1990; Westeren, 2008a,b; Russ and Jones, 2008). More recently, three main strands in the literature dealing with the impact of intangible cultural capital on local development have emerged as: (i) the, mostly empirical, social capital literature; (ii) the broad diversity literature; and (iii) the game-theoretical literature on aggregate preferences.

The first, and most important, of these three strands deals empirically with the impact of aggregate attitudes on local development and focuses on the attitudes of trust between people. This has evolved into the social capital research in the economic literature on the effect of intangible local cultural capital (see, e.g., Banfield, 1958; Putnam, 1995; Glaeser et al., 2000; Knack and Keefer, 1996; Westlund and Calidoni-Lundberg, 2007; Othman and Zeghal, 2010; Westlund et al., 2013; Choi and Johnson, 2014).

The second main strand of the literature on the impact of intangible local cultural capital stems from the concept of diversity. It adopts a somewhat different viewpoint on the mechanism of the impact of aggregate cultural attitudes and their interaction in a culturally heterogeneous context that has been widely documented, starting with studies on Italy and the USA (Ottaviano and Peri, 2004; Tabellini, 2010) and then on many other places in Europe. Another sub-strand of the literature on the diversity of aggregate preferences concentrated in a locality is rooted in the work of Jacobs (1961) and was recently revitalized in the work of Florida (2002a,b; 2005)[2]. Migration has been yet another major sub-strand in the diversity stream with various interpretations, often starting from the difference in intangible cultural attitudes and then bringing the discourse into the tangible field through leisure-class consumption or ethnic goods and services in a locality (Veblen, 1899, 1919; Baumol, 1986; Constant et al., 2012; Bakens et al., 2015).

Finally, theoretical models of the relativity of internal and external preference orders have also been developed (see, for example, Sen, 1993; Hong and Page, 2001). The theoretical attempts to understand the impact of intangible cultural capital – namely preferences – have been rather intensive. This topic was mainly explored in the voting-related game-theoretical literature (Arrow, 1951). Alternative models are the Polya process for approximating path dependence (Bednar et al., 2012; Page and Toole, 2010) and the spatial selection process (Axelrod, 1997), or replicatory dynamics, which is an attempt to trace the aggregation of 'nature's preferences' over time by natural selection, i.e., the survival of the fittest (Golman and Page, 2009). In addition, the Schelling agent-based model demonstrates how individual differences have an aggregate effect on local ethnic segregation (for a recent summary, see Arribas-Bel et al., 2015). While the above-mentioned three main strands of the literature on the impact of intangible cultural capital are methodologically very diverse, their common pattern is that they all explain socio-economic discrepancies by the intangible cultural capital characteristic on the aggregate level.

Greece is a country with significant spatial disparities. Numerous regional inequalities have also been well-documented, yet their relation with local intangible cultural capital has not been properly explored. For instance, from both anecdotal and agglomeration evidence[3], a North-South divide seems to exist in Greece, just as in Italy, though with reverse values. However, no attention has been given to intangible cultural capital as an impact factor for that phenomenon. One reason for this may be that religion has been a traditionally inferred variable in relation to culture ever since Weber's contributions in the field of sociological economics and local attitudes (i.e., intangible local cultural capital). In Greece, however, the religion is almost entirely Orthodox Christianity, so that, at least at first sight, no local variance seems to exist. This, however, is over-simplistic, as local attitudes to religion may still vary in terms of their traditional bond versus modern views, etc., while the difference in attitudes can reach far beyond religion itself. Indeed, the different regions of Greece are characterized by specific attitudinal inclinations, even if so far this has been supported mostly only by considerable anecdotal evidence.

[2] An interesting overview of approaches to measuring diversity is that of Nijkamp and Poot (2015), while the controversy over the results in this field is discussed in a recent contribution by Rodriguez-Pose and Berlepsch (2014) and Arribas-Bel et al. (2016).

[3] For instance, Athens, the capital city, concentrates most of the population and has a clear income advantage in comparison to the rest of the country; traditionally, the economically prosperous cities tend to be often located by the sea or a river.

The economic discrepancies in the country are serious and extensively studied. The literature on economic growth in Greece has always provided clear evidence for significant and persistent economic disparities between regions (Siriopoulos and Asteriou, 1998; Tsionas, 2002; Prodromidis, 2006; Benos and Karagiannis, 2007a,b). Moreover, during the recent crisis period, the statistical data have clearly demonstrated that impoverished regions tend to lose more jobs and thus receive a heavier blow from the crisis (Karagiannis and Benos, 2009; Rodriguez-Pose et al., 2012). Among others, an initial study conducted by Siriopoulos and Asteriou (1998), based on local differences in GDP per capita for three periods (1971–1981, 1981–1996, 1971–1996) and applying alternatively the approaches of Mankiw et al. (1992) and Barro and Sala-i-Martin (1991), captures a significant polarization of economic development in Greece at the NUTS-II level (13 regions). Later, Petrakos and Saratsis (2000) tested economic disparities at the NUTS-III level in Greece for the period 1971–1991, and their findings suggested that regional inequalities in Greece have a pro-cyclical character (increasing in periods of economic expansion and decreasing in periods of economic recession)[4].

The above findings link regional disparity problems in Greece directly with Gunnar Myrdal's theory of cumulative causation (Myrdal, 1957), which implies the existence of vicious circles of development (i.e., ever-increasing deepening of poverty and regional disparities over time). This Myrdalian cultural attitude-driven cumulative causation[5] can also explain the different returns to schooling in different localities in the long run and the inconsistency of the empirical results on the human capital effects on growth in Greece identified in the literature (Temple, 1999; Krueger and Lindahl, 2001; Papageorgiou, 2003; Di Liberto, 2008; Karagiannis and Benos, 2009). Additionally, Rodriguez-Pose et al. (2012) demonstrated that public investment has a positive impact on growth, but not on convergence, in Greek NUTS-III regions for the period 1978–2007. Public and private investment, industry-wise, was, however, reported by Benos and Karagiannis (2007b) to be highly heterogeneous, resulting in different growth paths for the 13 NUTS-II Greek regions during the period 1995–2003.

All these results strongly indicate that Greece is experiencing not only a polarization of its regional development, but even more so cumulative causation and vicious circles of poor regions growing poorer over time. What is expected from theory (Myrdal, 1944, 1957, 1968, 1989) – and also observed in Greece (Petrakos and Saratsis, 2000) – is that inequalities decrease in times of economic recession. In line with Myrdalian thinking, if poor regions keep growing poorer, and if there is an economic recession which negatively affects the growth in rich regions, it is natural that a decrease in inequality among regions will result. This suggests an overall decrease in output and income and a spiral movement of the whole economy into a vicious circle of impoverishment, which was previously characteristic only of poor regions. Yet, in spite of all these indications of the role of cultural attitudes, i.e., the impact of intangible local cultural capital on local development in Greece, the topic has remained almost virgin territory for research.

The paper aims to explore the intangible local cultural capital in Greece, addressing the question through the definitions and mechanisms suggested by the growing, in terms of accumulated evidence, Culture-Based Development (CBD) concept. Our work focuses on approximating only that part of cultural capital which is intangible. Our findings indicate the high significance of intangible local cultural capital.

The structure of the remainder of this paper is as follows. Section 2 briefly discusses the CBD model of

[4] These findings also generally agree with the results of Michelis et al. (2004), Lyberaki (1996), Petrakos and Pitelis (1999), Petrakos et al. (2000), Petrakos and Tsoukalas (1999), Tsionas (2002), and Alexiadis and Tomkins (2004), who also found somewhat patchy tendencies of convergence over time of different spatial levels (prefectures, cities, etc.).

[5] In the context of development economics, Myrdal (1957) explained that the process of regional policy makers' choices for resource allocation is strongly determined by, among other things, the predominant cultural attitude in a locality. As an example, Myrdal discussed the U.S. color-biased investment in education, where the attitude towards blacks as an uneducated segment of human capital, unworthy of further investment, results in the deterioration of the literacy and skill levels among this segment of the population over time. This 'vicious circle' means that, depending on the cultural attitude to the reallocation of resources, poor regions may end up receiving relatively low investments in education (and other fields of socio-economic activity) (Sianesi and van Reenen, 2002). In particular, lower regional investments in education over time will mean that the poor region, which is unattractive for high-skilled emigrants from other regions, will also decrease its incumbent level of human capital. This results in a decrease in the GDP generated in the next period. Thus, in spite of emigration, there is also less GDP to distribute among the remaining local population, while positive convergence effects cannot happen in the poor locality. The same mechanism with the signs reversed prevents immigration from decreasing the wages in rich localities, which even enhances productivity further.

local cultural capital as the determining factor for enlarging the resources for local productivity. Then we aim to operationalize this CBD model in order to test our main working hypothesis which deals with the impact of intangible local cultural capital on regional economic discrepancies in Greece. Section 3 then presents our database, the estimation strategy used, and the empirical results. Section 4 provides some concluding remarks and makes some suggestions for a possible extension of the current analysis.

2. CBD: the cultural input for productivity

In a search of a theoretical foundation for investigating the impact of intangible cultural capital in Greece, we direct our attention to the newly emerging concept of *Culture-Based Development* (CBD) (Tubadji, 2012, 2013; Tubadji and Nijkamp, 2014, 2015a,b), which provides a systematic framework for analyzing the impact of culture on regional development. CBD is a conceptual framework that synthesizes the knowledge on culture as a form of capital transferred from the original individual level (as introduced by Bourdieu, 1973, 1977, 1986; Bourdieu and Passeron, 1977) to the collective local level. CBD provides a definition of the input that culture represents, its dynamic endogenous nature, the complex but clearly programmed mechanism of cultural impact, and the size and direction of this impact on increasing the productivity of all other inputs. We use the CBD model as a foundation to focus on intangible local cultural capital impact in particular.

CBD defines culture as a dual form of capital, i.e., an input for productivity, which has an immaterial (intangible) nature (attitudes, values, etc.) and a materially clearly observable (i.e., tangible) embodiment (i.e., previously produced cultural objects and activities). Both forms can be categorized according to a time divide into living culture (the material and immaterial cultural capital of the present time) and the cultural heritage (material and immaterial surviving elements from previous historic periods). This cultural capital has built up a unique cultural milieu for each locality and left a footprint through the mechanism of embeddedness in the order of preference of the individuals who live in that locality (for a more detailed summary of the CBD conceptual framework, see Appendix 1).

CBD suggests that the cultural mechanism of impact should be regarded as a two-gear mechanism. The first gear operates as a cultural spatial segregation of human capital according to cultural compatibility and economic incentives, while the second gear is a culturally-biased decision-making process whereby individuals with different cultural backgrounds interact and ultimately make their crucial group-influenced decisions on each aspect of economic activity. This second gear is the one in which locally-generated human capital and its cultural relativism induces impacts that influence the degree of deepening of all available resources, as well as the degree of innovation that will be achieved in the locality (see Tubadji, 2012, 2013; Tubadji and Nijkamp, 2014, 2015a,b).

To formalize the above, first the dependence between the formation of human capital and culture, i.e., the first gear of the CBD mechanism, can be expressed by the following Cobb–Douglas type of production function:

$$HC_{it} = Y^{\alpha}_{i(t-n-m)} Y^{\beta}_{i(t-n)} CC^{\gamma}_{it}, \quad (1)$$

$$0<a<1, \quad 0<\beta<1, \quad 0<\gamma<1,$$

$$i = 1,2,\ldots k, \quad t = 1,2,\ldots T,$$

where HC is the percentage of highly-qualified workers employed in a locality; Y is the output in, respectively, the t-n and t-n-m time periods, $m>n>0$, and CC is the cultural capital in region i at time t. Cultural capital is, however, a complex vector variable, comprising in its matrix: (i) ethnic diversity, DIV, capturing local embodied cultural capital; (ii) cultural assets, i.e., cultural heritage and modern cultural amenities, capturing objectified cultural capital; and (iii) cultural attitudes, CA, capturing institutional cultural capital, since cultural attitude is the proto-institution which forms all other institutions (for more details, see Tubadji (2012, 2013)). Ethnic diversity is a product of the stock variable of ethnic composition in a locality. It can be argued, however, that it is endogenous to both local economic development and culture, and thus empirically rather unlikely to perform as a meaningful indicator, unless treated for this endogeneity. This perspective ties in with recent methodological research on cultural diversity and heterogeneity (Nijkamp and Poot, 2015). Cultural heritage is a constant for relatively short periods of time, likely to be less than half a century (which is a commonsense average aging period of an asset before it can be thought of as 'heritage'), and therefore cultural heritage cannot easily be addressed empirically as a factor for dynamic dependencies. Our available data for this study belong, however, to the category of cultural attitudes. Cultural attitudes are, moreover, a changing variable which carries parts of local cultural heritage in a path-dependent manner and reflects the

economic and social effects on local culture and its transformation in recent periods. Thus, we can further extend our model as follows:

$$HC_{it} = Y^{\alpha}_{i(t-n-m)} Y^{\beta}_{i(t-n)} DIV.CA^{\gamma}_{it}, \quad (2)$$

which is identical to:

$$HC_{it} = Y^{\alpha}_{i(t-n-m)} Y^{\beta}_{i(t-n)} DIV^{\gamma}_{it} CA^{(\gamma-1)}_{it}. \quad (3)$$

Next, the stock of human capital produced through local investment and attracted in the form of immigrants is included as a production factor in the formation of local output over time. Thus, we arrive at the second gear of the CBD mechanism of cultural impact on local productivity. This second gear can be presented in the context of endogenous growth models, as a slightly modified version of the model developed by Bairam and McRae (1999) and Christopoulos and Tsionas (2004), for testing convergence between localities, which is derived from a simple production function:

$$Y_{it} = A_i(t) K^{\alpha}_{it} L^{\beta}_{it}, \quad (4)$$
$$0<a<1, \quad 0<\beta<1,$$
$$i = 1,2,\ldots k, \quad t = 1,2,\ldots T,$$

where Y stands for output, K for capital, and L for labor in region i at time t.

The CBD-instigated modification of model (4) originates from the premise that it is not the sheer size of the available workforce that is sufficient to efficiently utilize the resources in the knowledge-based age of regional development. This is in accordance with endogenous growth theory, according to which it is, in particular, human capital, skill level, and the share of highly-skilled R&D personnel that have an impact on growth. To highlight this idea, CBD starts from the rather usual model specification of endogenous growth:

$$Y_{it} = A_i(t) K^{\alpha}_{it} HC^{\beta}_{it} L^{(1-\beta)}_{it}, \quad (4')$$
$$0<a<1, \quad 0<\beta<1,$$
$$i = 1,2,\ldots k, \quad t = 1,2,\ldots T.$$

In other words, we include not only the number of workers, but also the share of skilled workers in the production function.

The full CBD model requires that the cultural effect on the formation of local human capital is also reflected in the model. Therefore, to respect the theoretical setting discussed above, the local growth process is expressed by CBD in terms of the following recursive growth model:

$$HC_{it} = Y^{\alpha_1}_{i(t-n-m)} Y^{\beta_1}_{i(t-n)} DIV^{\gamma_1}_{it} CA^{(\gamma_1-1)}_{it},$$
$$Y_{it} = A_i(t) K^{\alpha_2}_{it} HC^{\beta_2}_{it}. \quad (5)$$

Taking the natural logarithms of the above system of equations and dividing them by the number of workers (L) expresses the local share of skill levels and the share of the cultural capital stock. In this way, we obtain local output and physical capital on a per-worker basis. By suppressing the intercept, we obtain:

$$\ln hc_{it} = a_1 \ln y_{i(t-n-m)} + \beta_1 \ln y_{i(t-n)} + \gamma_1 \ln div_{it} + (\gamma_1 - 1) \ln ca_{it},$$
$$\ln y_{it} = \ln A_i(t) + a_2 \ln k_{it} + \beta_2 \ln hc_{it} + (1 - a_2 - \beta_2 - \gamma_2) \ln L_{it}, \quad (6)$$

where *hc* stands for the regional share of human capital per worker; *div* and *ca* are, respectively, the ethnic diversity and share of particular cultural attitudes per worker; *y* indicates regional output per worker; and k_{it} (= K_{it}/L_{it}) represents the stock of physical capital per worker.

Differentiating the system of equations (6) with respect to time *t* yields a Cobb–Douglas type of growth equation in the second equation of our system, from which non-constant returns to scale can be analysed as a factor for local convergence:

$$dhc_i = a_1 (d_{(t-n-m)} Y_i - d_{(t-n-m)} L_i) + \beta_1 (d_{(t-n)} Y_i - d_{(t-n)} L_i) + \gamma_1 (dDIV_i - dL_i) + (\gamma_1 - 1) (dCA_i - dL_i),$$
$$dy_i = \psi_i + a_2 (dK_i - d L_i) + \beta_2 (dHC_i - d L_i) + (1 - a_2 - \beta_2 - \gamma_2) dL_{it}, \quad (7)$$

In the first equation, $dCAi \equiv d(\log CA_i))/dt$ is a vector variable *CA* composed of relevant cultural attitudes (i.e., important cultural markers)[6]. In the second equation, $dK_i \equiv d(\log K_i)/dt$, $dHC_i \equiv d(\log HC_i)/dt$, and $dL_i \equiv d(\log L_i)/dt$ can be interpreted, respectively, as the growth rates of capital, human capital, and labour, while $\psi_i \equiv d(\log A_i)/dt$ denotes the rate of technical progress. Similar to Bairam and McRae (1999) and Christopoulos and Tsionas (2004), we interpret the model

[6] This is to avoid under-specification due to the omission of important variables, the risk of which is much higher if culture is approximated by a single cultural attitude variable varying in time.

as follows: the coefficient of *dLi* could be either positive or negative, meaning that the contribution of labor can differ depending on the returns to scale. Yet, as long as $a_2 > 0$ and $\beta_2 > 0$, the role of, respectively, *capital deepening* and the *local concentration of human capital* are always positive. Assumptions regarding ψ_i can vary between treating it as a constant, allowing it to vary linearly in relation to initial productivity levels, or even to exhibit non-linearities. Clearly, based on the above rationale, the CBD framework is endogenous to economic development. The recursive in nature CBD model (7) fully reflects the endogeneity specificities throughout time and also allows for their accurate empirical treatment. We can then operationalize this for the case of Greece on the NUTS3 level for the period before the current crisis. Thus we can conduct a test of our main research hypothesis:

H1: *Cultural attitudes determine local economic productivity by triggering the mechanism of regional technological advancement and capital deepening.*

In the following section we operationalize our working hypothesis for the case of Greece, and present the data, estimation strategy, and, finally, the analysis and results for the country of interest.

3. Empirical analysis for the case of Greece, 2002–2009

3.1. Database

To treat model (7) empirically, we employ a 3SLS method for both a simple and a pooled cross-section regression analysis. As the data set in the simple cross-sections is small, we address the cross-sections for 2002 and 2004 separately to avoid any time and space biases. Finally, we address the bigger pooled cross-section for 2002, 2004, and 2008, adding time and space fixed effects, in order to investigate all available data. The comparison between the simple and the pooled cross-sections will serve as an application of the mixed method of triangulation, which will inform us about the reliability of our results.

To provide our two types of data sets, we use two data sources, EUROSTAT and the European Social Survey (ESS). Our geographical unit of analysis is the NUTS-II level, the middle sub-national level, because this was the only available level for both the cultural- and the human capital-related data. The ESS is a source of data on cultural attitudes which is available for 2002–2010 on a biennial basis. Thus, as cross-sections we address the years 2002 and 2004. The year 2006 is a missing year for Greece, while 2008 has two missing regions (see Appendix 2 for more details). The standard socio-economic indicators informed by EUROSTAT data are GDP, GDP per capita, total local population, population density, workers over 15 years old, workers with tertiary or higher levels of education (human capital), and share of employment in each sector of the economy.

To operationalize the CBD definition of local culture, we focus on the immaterial (i.e., intangible) part of (i) living culture and (ii) cultural heritage. The first - immaterial living culture - is quantified using the data from the ESS in either a mono-dimensional traditional approach or according to the CBD recommendation, with an aggregate vector variable (for more details, see Tubadji (2012, 2013)). The selected mono-dimensional cultural attitudes to be taken into consideration are variables that have been proposed in the economics literature as key cultural attitudes with a possibly strong impact on socio-economic development. These attitudes are: religion (Weber, 1905; Barro and McCleary, 2003, 2005); trust (Guiso et al., 2006; Knack and Keefer, 1996; La Porta et al., 1997; Gambetta, 2000); innovation (Schumpeter, 1934; Niebuhr and Peters, 2012; Ozgen et al., 2013); and creativity and traditionalism (approximating cultural closedness) (Florida, 2002a,b, 2005). As the religion in Greece is predominantly Orthodox Greek, we assume that the effect of being strongly traditional involves the effect of religiosity, which in this case cannot be captured through the statistical variance of the religious identity of the population (for more details, see Appendix 2). Regarding the quantification of the vector variable of immaterial living culture (see the previous section), the CBD approach actually recommends this vector-quantification approach to cultural capital. Therefore, in the next stage we amass a much bigger number of cultural attitudes from the European Social Survey related to different values and beliefs (as in Tubadji and Nijkamp, 2014). After implementing a factor analysis on the individual level and then aggregating the data on the NUTS-I level, we obtain three vector variables for local cultural capital. The three variables *CC_passive, CC_negative* and *CC_positive*, summarize, respectively, the levels of cultural attitudes that reflect a passive attitude to change and innovation, negative attitudes to immigrants and others (such as low level of trust among others), and generally optimistic and altruistic attitudes to life (for an extensive description of these variables, see Tubadji and Nijkamp, 2014). We call all

these three alternative vectors the 'CC vector' for the sake of brevity throughout the current paper[7].

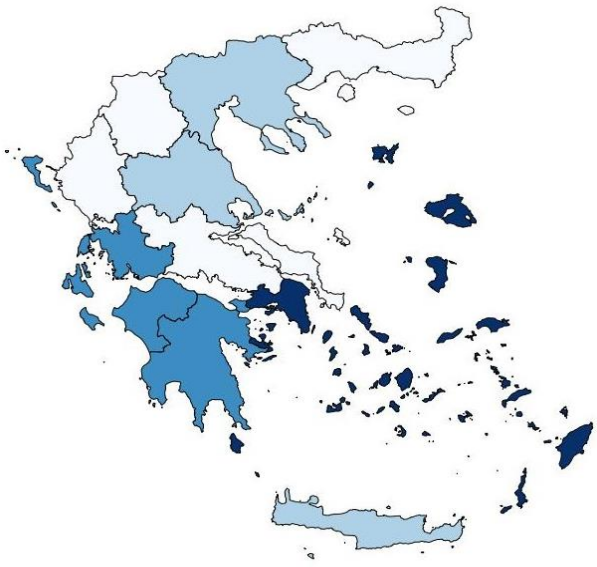
To quantify the second part of intangible cultural heritage we need a historic variable that will approximate culture but will not be susceptible to current socio-economic events. Such a choice always implies some arbitrariness. In this case, we opt to use the number of surviving Jews living in Greece after the Nazi period of World War II (hereafter WWII). This variable carries a double significance: (i) it indicates the existing ethnic diversity in the country, which was much bigger before the WWII, and this variable informs us about which regions were the past centres of diversity, as most of the surviving Jews simply remained where they used to be before the war; (ii) the war was an external shock that changed the diversity pattern in the country. Thus, by using this variable we infer information on the places where this war shock was focused and can be expected to truly indicate potential nests of the persistence of culture effects. The data is obtained from Bowman (2002). We have then in our model variable *jew1*, which represents the actual number of Jews on the NUTS-II level. We transformed the data into a zero or one indicator *jew2*, which has a value of 1 when a locality has surviving Jews and 0 otherwise. Variable *jew5* is the share of Jews in the local population. As material cultural capital normally tends to embody a deeper endogeneity dependence than the immaterial one, and as our data set is small, we prefer to focus our analysis here on the immaterial cultural capital as defined by CBD.

Finally, Maps 1-4 provide an empirical basis for intuition about the spatial meaning of the cultural variables. The maps indicate that there is a positive relationship between human capital and local GDP per capita, which is to be expected. Meanwhile, local cultural heritage, in terms of love for diversity measured in terms of the post-WWII concentration of Jews in the locality, seems to have a spatial concentration that is totally opposite in pattern to local negative cultural attitudes, which confirms our historic variable as a measure of an open-minded local cultural milieu. Based on this visual analysis of the data, we expect the data set to provide reliable and interesting results. This will be tested in section 3.2.

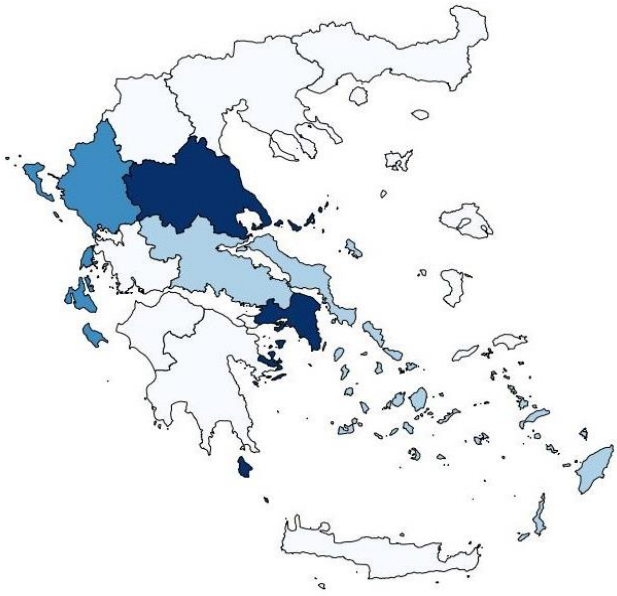
Map 1. GDP per capita, NUTS-II2 level, Greece, 2002, deeper blue represents higher values.

Map 2. Human capital (share of people with tertiary education), NUTS-II level, Greece, 2002, deeper blue represents higher values.

[7] In the second part of our empirical work we use the variable CC as the average of the individual cultural variables used. This is a preferable quantification of the CC vector in the case of pooled cross-section. As described later, we perform a certain artificial generation of the missing data, based on a linear function assumption. The less artificial transformations to which the cultural data has been subjected, the closer these are to reality, and the smaller the eventual aggregation error will be. Therefore, we obtain CC in the pooled cross-sections through only one aggregation step – direct calculation of the average from the individual values. The alternative would be to first aggregate the CC vector for each year and then generate the artificial values for each missing year, which involves two steps of reprocessing the data. In view of the above, we opt for the first approach.



Map 3. Living Culture: factor variable *CC_negative*, NUTS-II level, Greece, 2002, deeper blue represents higher values.



Map 4. Cultural Heritage: variable *jews5*, NUTS-II level, Greece, 2002, deeper blue represents higher values.

3.2. Estimation strategy

Using the data described in the previous section, the present section will examine in detail the main theoretical proposition on the intangible cultural capital effects on local human capital accumulation, productivity, and capital deepening expressed in model (7), in Greece[8].

We perform two main types of estimations. First, we use the cross-sections for 2002 and 2004 to obtain a three-stage least squares (3SLS) estimation of the CBD system of two equations which precisely reflect the structure of our theoretical model (7) to test its relevance for the Greek NUTS2 level. The first equation of the CBD model explains differences in human capital (*s_HC*) as a function of differences in past investment in education, approximated by the average level of GDP over the past five years (*s_gdpM*), and differences in local living cultural capital (alternatively quantified with the four individual attitudes – innovation, trust, new ideas, and traditionalism – as well as our Jew-index variable and the aggregate *CC* vector variables described above). The second equation explains differences in the convergence of local productivity per worker (*s_gdppc*) as a function of the following determinants: local share of physical capital (*s_K*), local share of labour (*s_L*), and local share of human capital (*s_HC*) (all the former reflecting capital deepening), as well as a control variable for share of agricultural sector employment (*s_AGRI*) to serve as a control for structural effects on convergence[9]. Finally, a pooled cross-section data set is composed. We have real data on the economic variables from 2002 to 2009, all available from EUROSTAT. The cultural data are for the years 2002, 2004, 2006, and 2008. We generate the missing year values for 2003, 2005, 2007, and 2009, assuming a linear functional form for the development of culture and using the available real data for the above-mentioned years from the ESS. We perform an OLS regression with beta coefficients on this pooled data set and then perform estimations with fixed and random effects. The results are triangulated by first using the full data set 2002-2009 for the estimations. In the next step, only the data for

[8] Differences between the inter-local and intra-local applications of the model can be distinguished. We might incorporate country dummy variables capturing such differences, but this would increase the number of regressors and decrease further the already low degrees of freedom for the estimations. For a distinction between the inter- and intra-local applications of the model, see Tubadji (2012, 2013).

[9] All variables in our empirical model are taken as natural logarithms. The model is self-identified, since it is a recursive model, where the dependent variable from the first equation (local human capital) appears as a regressor and explanatory variable in the second equation of the system. The advantage of this method is two-fold: it reflects closely the structure of the theoretical model and it is self-identified. Clearly, further locality-specific or temporal developments may remain outside the scope of the 3SLS estimation. Moreover, as our NUTS-II level has a low number of observations, this estimation serves more as an initial descriptive exploration of the data sets than an actual analytical attempt.

2002, 2004, 2006 and 2008 will be used. If the results are consistent, we will accept our linear function assumption regarding the cultural data as reasonable.

Additionally, in order to cross-check whether our data are suitable for estimations with a pooled data set, we conduct three basic post-estimation tests. These tests are the LBI/BNF, the Lagrange Multiplier (LM), and a Hausman test (for more details about the tests, see Appendix 3).

3.3. Results

The primary empirical objective of this study is to cross-check the adequacy of the CBD framework in explaining regional development in Greece with regard to intangible cultural capital. As seen from Table 1a-b below, the descriptive statistics in our data set offer promising indications regarding the relationship between the economic and cultural variables in Greece.

Table 1a. Correlation between variables in 2002.

	gdp_pw	s_empl	s_agri	s_hc	s_ntr	s_nid	s_ninnov	s_vtrad	CC	jew1	jew2	jew5
gdp_pw	1											
s_empl	-0.13	1										
s_agri	-0.84	0.17	1									
s_hc	0.00	0.10	-0.43	1								
s_ntr	-0.10	0.14	0.12	-0.18	1							
s_nid	0.29	0.32	-0.14	-0.32	-0.05	1						
s_ninnov	0.19	0.09	-0.08	-0.46	-0.01	0.69	1					
s_vtrad	-0.71	0.33	0.47	0.30	0.13	-0.41	-0.30	1				
CC	-0.08	0.37	0.13	-0.36	0.67	0.58	0.64	0.09	1			
jew1	0.34	0.21	-0.64	0.84	-0.01	-0.14	-0.21	-0.01	-0.16	1		
jew2	0.46	0.05	-0.59	0.26	-0.05	0.33	0.53	-0.10	0.31	0.41	1	
jew5	0.21	0.11	-0.50	0.74	-0.17	-0.20	0.00	0.18	-0.14	0.81	0.70	1

Notes: The table presents the correlation coefficients between the variables for a regular one year data set (year 2002).
Source: Authors' own calculations.

Table 1b. Correlation between variables in 2002-2009 pooled cross-section.

	gdp_pw	s_empl	s_agri	s_hc	s_ntr	s_nid	s_ninnov	s_vtrad	CC	jew1	jew2	jew5
gdp_pw	1											
s_empl	0.17	1										
s_agri	-0.76	-0.01	1									
s_hc	0.32	0.16	-0.51	1								
s_ntr	-0.05	0.03	0.16	0.07	1							
s_nid	-0.04	-0.03	-0.07	-0.18	-0.95	1						
s_ninnov	-0.02	-0.02	-0.08	-0.16	-0.96	0.99	1					
s_vtrad	-0.09	0.03	0.17	0.08	0.97	-0.97	-0.98	1				
CC	-0.40	0.00	0.35	-0.44	-0.11	0.39	0.36	-0.18	1			
jew1	0.35	0.23	-0.62	0.71	-0.01	-0.05	-0.05	0.02	-0.18	1		
jew2	0.31	0.16	-0.51	0.16	-0.11	0.10	0.11	-0.10	0.03	0.41	1	
jew5	0.18	0.21	-0.45	0.62	-0.03	-0.05	-0.03	0.03	-0.17	0.81	0.70	1

Notes: The table presents the correlation coefficients between the variables in our pooled dataset 2002-2009.
Source: Authors' own calculations.

Each individual cultural variable appears to have a strong – though different and sometimes negative, sometimes positive – correlation with local productivity per worker (*gdp_pw*). The *CC* variable in Table 1a-b is the average of the individual cultural variables in the same table. This *CC* variable is used to estimate only the pooled cross-section estimation. Alternatively, when investigating only the year 2002, we use the aggregated vector variables *CC_passive, CC_negative*, and *CC_positive*, which represent, respectively, passive, positive, or negative attitudes in the local milieu. *CC* in the pooled cross-section and *CC_passive*

have similar correlation coefficients with *gdp_pw*. Meanwhile, the percentage of Jews after WWII (which we keep as a fixed characteristic, initial-conditions-setter for every individual year) appears to have a relatively similar relationship with local productivity for each year of the period 2002-2009. The behavior of the economic variables is also logical and reliable. Further clarity on the reliability of our pooled cross-section can be obtained by looking at the relationships represented by the regression lines in Figures 1 to 4.

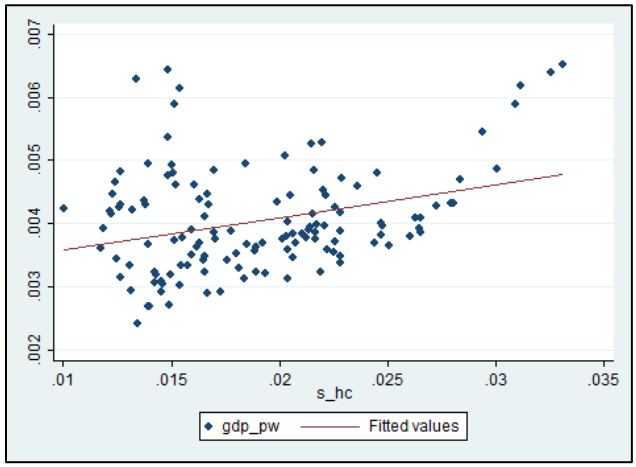


Figure 1. Pooled Cross-Section regression line: gdp per capita and share of human capital, 2002-2009.

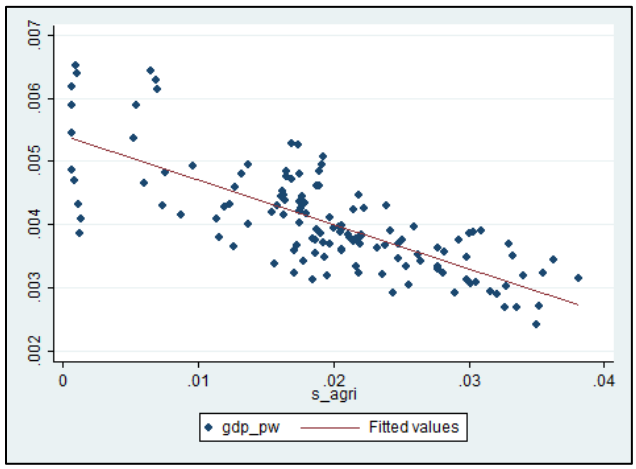


Figure 2. Pooled Cross-Section regression line: gdp per capita and share of agricultural activity, 2002-2009.

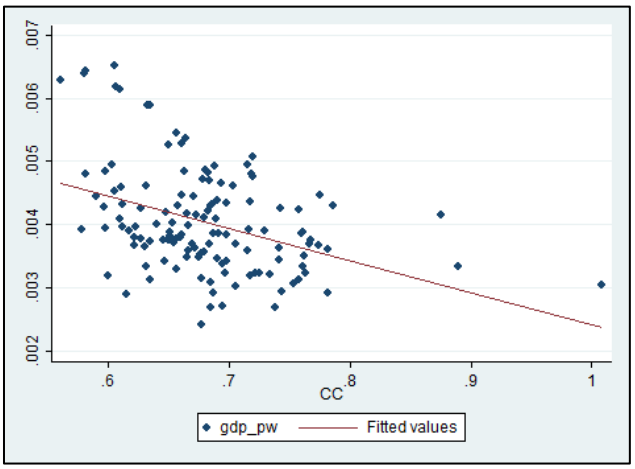


Figure 3. Pooled Cross-Section regression line: gdp per capita per capita and local cultural capital levels, 2002-2009.

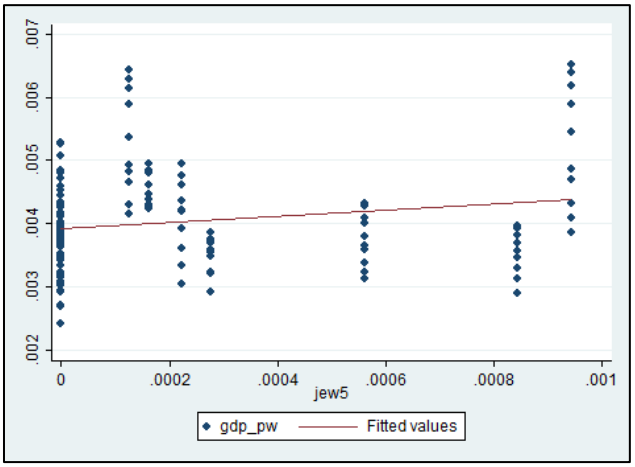


Figure 4. Pooled Cross-Section regression line: gdp per capita capita and share of Jews in the locality after the WWII, 2002-2009.

From Figure 1 and 2 we can see that our pooled data set does indeed behave as expected from the perspective of standard economic theory. Namely, there is a significant positive relationship between local productivity and human capital and a negative relationship between productivity and agricultural activity, i.e., rural areas are less economically prosperous. Regarding the cultural variables (see Figures 3 and 4), we observe that living culture, our aggregate vector variable measure *CC*, has a strongly significant negative relationship with local productivity. Meanwhile,

the fixed (in the current point of time, as assumed by CBD) characteristics of cultural heritage – quantified by the variable *jew5* – also indicate a slightly positive relationship with the studied ten-year period of economic development in Greece. In short, our indicators seem to perform relatively reasonably well and are consistent with the descriptive data available for the years 2002, 2004, 2006, and 2008. Thus our descriptive analysis using the early data is reinforced by the pooled cross-section results, which will have consistent statistical characteristics and increasestatistical explanatory power because of the amassed number of observations.

To obtain a first descriptive impression of the relevance of the CBD model for Greece, we apply a simplified version of the model for each available ESS in 2002 at the NUTS-II level in order to cross-check the adequacy of the model in a static condition regarding time and space. Table 2 presents the results from our 3SLS estimations for the year 2002.

Table 2. Cross-sectional analysis, NUTS2, 2002, coefficients and t-values.

dep.var.1	**hc2**															
gdppc5_02	1.730	*0.34*	-3.808	*-0.56*	-4.727	*-0.69*	0.114	*0.02*	2.761	*0.45*	0.538	*0.07*	0.270	*0.03*	-4.049	*-0.94*
CC_passive	-0.002	*-2.47*														
CC_negative			0.000	*1.95*												
CC_positive					0.000	*0.98*										
s_trust0_02							0.036	*0.38*								
s_innov0_02									-0.162	*-1.08*						
s_idea0_02											-0.006	*-0.03*				
s_trad0_02													-0.009	*-0.04*		
jew5															111.7	*4.44*
_cons	0.121	*2.03*	0.223	*2.66*	0.226	*2.74*	0.150	*1.98*	0.268	*2.15*	0.162	*1.45*	0.169	*0.59*	0.184	*3.65*
Parms	2		2		2		2		2		2		2		2	
RMSE	0.040		0.046		0.045		0.047		0.043		0.046		0.046		0.029	
R-sq	0.26		0.01		0.05		-0.04		0.14		0.00		-0.01		0.60	
chi2	6.48		3.86		1.23		0.15		1.17		0.01		0.01		19.88	
P	0.0391		0.1454		0.5416		0.9265		0.5576		0.9973		0.9968		0.0000	
dep.var.2	**g02**															
k2	0.007	*2.02*	0.016	*2.50*	0.020	*2.06*	0.011	*2.32*	0.008	*1.99*	0.011	*2.00*	0.009	*2.25*	0.006	*2.91*
la2	2.433	*1.66*	2.209	*1.20*	2.349	*1.02*	2.852	*1.44*	3.754	*2.13*	3.021	*1.42*	3.278	*1.77*	3.971	*2.82*
hc2	0.037	*1.63*	0.123	*3.44*	0.174	*3.09*	0.090	*3.10*	0.051	*2.05*	0.090	*2.54*	0.068	*2.55*	0.021	*1.95*
agg2	-0.00004	*-3.59*	-0.00006	*-3.45*	-0.00007	*-2.84*	-0.00006	*-3.62*	-0.00005	*-3.91*	-0.00006	*-3.29*	-0.00005	*-3.79*	-0.00005	*-4.84*
_cons	-0.006	*-0.74*	-0.026	*-2.46*	-0.038	*-2.39*	-0.019	*-2.14*	-0.013	*-1.72*	-0.019	*-2.02*	-0.016	*-1.77*	-0.008	*-1.46*
Parms	4		4		4		4		4		4		4		4	
RMSE	0.001		0.005		0.007		0.003		0.002		0.003		0.002		0.001	
R-sq	0.47		-4.04		-9.59		-1.65		0.13		-1.67		-0.50		0.70	
chi2	13.68		21.18		21.09		20.17		19.15		16.67		17.83		31.15	
P	0.0084		0.0003		0.0003		0.0005		0.0007		0.0022		0.0013		0.0000	
N	13		13		13		13		13		13		13		13	

Notes: The table presents the estimation results of a 3SLS for a model composed of two equations. The estimation model includes: Equation 1, where the dependent variable (change in the concentration of skilled workers over time) is explained by the local change in: density of population, capacity for investment in HC over the past five years (s_gdpM, labelled HC2 above), concentration of cultural capital (approximated by three vector variables based on the aggregation of the attitudes from the European Social Survey, through principle component factor analysis as well as alternatively approximated by five individual variables: 1) shares of people in a locality who have low levels of trust, 2) shares of people in a locality who appreciate new ideas; 3) shares of people in a locality who are in favor of innovation; shares of people in a locality who practice a high level of traditionality; and 5) a measure of local cultural heritage and openness of the local milieu to the otherness – quantified by the historic variable – number of surviving Jews in the locality after the WWII)); and Equation 2, where local change in productivity per worker (s_gdppc, labelled g02 above) is explained by the changes in local physical (s_K) and human capital (s_HC) and is controlled for the structural differences between localities (in terms of share of employment in the agricultural sector). The model is self-identified because it is a recursive model. Therefore, in addition to the main estimations, only basic statistical tests are presented, which confirm the satisfactory performance of the model.

Source: Authors' own calculations.

As expected, based on the number of affordable parameters, we had to drop one of the theoretically-justified lagged GDP variables.[10] The overall results from the 3SLS estimation are statistically satisfactory and, overall, compliant with the main CBD expectations. The first equation shows no strong significance of local characteristics and confirms the Weberian link between human capital formation and local cultural capital. The second equation reports a somewhat changing significance of the share of the labor force; yet physical capital and human capital are strongly positively significant, while the size of the agricultural sector is a strongly negatively significant factor, as expected. This means that, in support of previous findings (Tsionas, 2002; Karagiannis and Benos, 2009; Rodriguez-Pose et al., 2012), the structural factor is strong with regard to local development patterns in Greece.

When controlling for the above structural effect, we still observe cultural effects with significant levels. In particular, the alternative measures of cultural capital involved are handled as follows. The aggregate vector variables for the quantification of cultural capital seem to have a high level of significance when their values are both negative and passive in terms of attitudes. But the positive cultural capital attitudes do not seem to be such a promising factor. This result can be interpreted in favor of a hypothesis that an open cultural milieu is a natural prerequisite for a normal productivity cycle, as otherwise the negative or stagnating cultural milieu would turn into a significant barrier to local development. The individual cultural attitudes are not reported to be significant factors for local productivity. Given the small number of observations, we are inclined to interpret this result in favor of the CBD empirical claim that the relevance of cultural attitudes for local development is most prominent at an aggregate attitudes level. The historic variable, i.e., the Jew Index, though mono-dimensional in nature but statistically free from endogeneity due to the long period reflected in the dependent variable, registers high levels of significance. In agreement with CBD expectations, this result means that local development in Greece is sensitive to initial conditions, pre-set by the historical path of formation of the local cultural capital.

We also run a simple OLS regression with robust standard errors with all variables involved in our 3SLS, and the results were mostly consistent, with R-squared reporting normal levels. These results are, however, sensitive due to the small data set limitations. Similar results were obtained in using the individual cross-sections for the years 2004, 2006, and 2008. Yet, these are descriptive results based on only 13 observations. Nevertheless, these descriptive results suggest two conclusions: (i) it seems that the cultural impact on local productivity in a CBD model-setting is likely to be relevant for Greece (in a way similar to Germany); and (ii) the cultural component is of relevance to local development (as it is also in Italy and the USA in a Putnam sense), especially because the indicator for cultural diversity *jew5* seems one of the most powerful cultural variables in the analysis. Moreover, the CBD-oriented approach using a multi-dimensional cultural vector variable is confirmed as a more powerful approach to capture the statistical significance of the attitudes in a locality. However, we need to reinforce these results with some further solid statistical testing.

Therefore, in a next step, we turn to a bigger pooled data set with 130 observations for the period 2002-2009. In order to remain prudent and use the available data most efficiently, we switch to a simple but precise test for the relationship between culture and local productivity in our data set. We regress local productivity on share of employment, share of agricultural activity, share of human capital, and a cultural variable, alternatively either one of our individual cultural variables, the vector variable *CC* (all these variables indicating living culture influence), or the *jew5* indicator (standing for cultural heritage influence). The results from our beta-coefficient estimations, as well as fixed and random effects comparisons for the reliability of our estimations and some additional standard tests are presented in Tables 3a, 3b, and 3c.

[10] We preserved the average value of the past five years, as this variable performed better and is theoretically more important. It reflects the local ability to invest in education, which expresses the incumbently generated skills in the local population. Using the five-year lag is also consistent with previous research in the same vein (see, for example, Glaeser and Gyourko (2006)).

Table 3a. Pooled Cross-Section, NUTS2, 2002-2004, coefficients and t-values from 3SLS.

dep.var.	**gdp_pw**											
	coef.	*t-val.*	coef.	*t-val.*	coef.	*t-val.*	coef.	*t-val.*	coef.	*t-val.*	coef.	*t-val.*
s_empl	0.593	*3.27*	0.598	*3.32*	0.601	*3.33*	0.595	*3.26*	0.636	*3.63*	0.701	*3.96*
s_agri	-0.079	*-12.82*	-0.079	*-13.03*	-0.079	*-12.97*	-0.078	*-12.58*	-0.074	*-12.55*	-0.082	*-13.78*
s_hc	-0.026	*-2.35*	-0.028	*-2.57*	-0.028	*-2.51*	-0.025	*-2.26*	-0.035	*-3.24*	-0.002	*-0.17*
s_ntr	0.0002	*1.61*										
s_nid			0.000	*-2.07*								
s_ninnov					0.000	*-1.92*						
s_vtrad							0.000	*1.05*				
CC									-0.003	*-3.56*		
jew5											-0.658	*-3.64*
_cons	0.004	*5.29*	0.004	*5.56*	0.004	*5.50*	0.004	*5.20*	0.006	*6.47*	0.003	*4.51*
F(4, 125) =	50.80		51.89		51.50		49.85		57.28		57.64	
Prob>F	0.0000		0.0000		0.0000		0.0000		0.0000		0.0000	
R squared	0.62		0.62		0.62		0.61		0.65		0.65	
Adj. R squ	0.61		0.61		0.61		0.60		0.64		0.64	
MSE	0.00052		0.00052		0.00052		0.00052		0.00050		0.00050	
N	130		130		130		130		130		130	

Table 3b. Pooled Cross-Section, NUTS2, 2002-2004, fixed effects, coefficients and t-values from 3SLS.

dep.var.	**gdp_pw**											
	coef.	*t-val.*	coef.	*t-val.*	coef.	*t-val.*	coef.	*t-val.*	coef.	*t-val.*	coef.	*t-val.*
s_empl	0.662	*2.13*	0.608	*1.98*	0.626	*2.03*	0.655	*2.10*	0.404	*1.34*	0.686	*2.17*
s_agri	-0.035	*-2.21*	-0.032	*-2.04*	-0.033	*-2.12*	-0.035	*-2.23*	-0.014	*-0.91*	-0.035	*-2.16*
s_hc	0.099	*4.53*	0.100	*4.68*	0.100	*4.64*	0.100	*4.60*	0.104	*5.04*	0.100	*4.48*
s_ntr	0.0002	*2.41*										
s_nid			-0.0002	*-3.04*								
s_ninnov					-0.0002	*-2.83*						
s_vtrad							0.0001	*2.22*				
CC									-0.0028	*-4.32*		
jew5											-	-
_cons	0.0003	*0.23*	0.001	*0.52*	0.001	*0.47*	0.000	*0.18*	0.003	*2.22*	0.000	*0.17*
sigma_u	0.00069		0.00071		0.00071		0.00070		0.00075		0.00069	
sigma_e	0.00036		0.00036		0.00036		0.00037		0.00035		0.00037	
rho	0.78377		0.79598		0.79224		0.78624		0.82515		0.77203	
R-sq within	0.60		0.61		0.60		0.59		0.64		0.57	
R-sq between	0.19		0.17		0.18		0.19		0.09		0.21	
R-sq overall	0.31		0.29		0.30		0.30		0.24		0.31	
F(4,113)	41.60		43.64		42.89		41.08		49.16		51.37	
F	0.0000		0.0000		0.0000		0.0000		0.0000		0.0000	
F (12,113) u_i=0:	11.83		12.16		12.04		11.92		12.40		11.31	
Prob > F =	0.0000		0.0000		0.0000		0.0000		0.0000		0.0000	
Groups	13		13		13		13		13		13	
N	130		130		130		130		130		130	
Serial Corr. Test:												
B Durbin-Watson	0.50		0.53		0.52		0.49		0.49		0.44	
Baltagi-Wu LBI	0.80		0.82		0.81		0.79		0.79		0.78	

Table 3c. Pooled Cross-Sectional, NUTS2, 2002-2004, random effects, coefficients and t-values from 3SLS.

dep.var.	**gdp_pw**											
	coef.	*t-val.*	coef.	*t-val.*	coef.	*t-val.*	coef.	*t-val.*	coef.	*t-val.*	coef.	*t-val.*
s_empl	0.855	*3.32*	0.833	*3.25*	0.845	*3.29*	0.859	*3.32*	0.746	*2.95*	0.850	*3.39*
s_agri	-0.066	*-6.32*	-0.065	*-6.23*	-0.065	*-6.27*	-0.066	*-6.30*	-0.056	*-5.28*	-0.070	*-6.81*
s_hc	0.035	*2.11*	0.034	*2.11*	0.034	*2.11*	0.035	*2.16*	0.032	*1.97*	0.047	*2.91*
s_ntr	0.0002	*2.11*										
s_nid			-0.0002	*-2.58*								
s_ninnov					-0.0001	*-2.39*						
s_vtrad							0.0001	*1.73*				
CC									-0.0025	*-3.69*		
jew5											-1.0111	*-3.20*
_cons	0.001	*1.40*	0.002	*1.67*	0.002	*1.62*	0.001	*1.33*	0.003	*3.07*	0.001	*1.59*
sigma_u	0.00029		0.00029		0.00029		0.00029		0.00029		0.00029	
sigma_e	0.00036		0.00036		0.00036		0.00037		0.00035		0.00037	
rho	0.39217		0.40024		0.39589		0.38940		0.41355		0.38051	
R-sq within	0.5662		0.5756		0.572		0.5627		0.5957		0.5516	
R-sq between	0.5371		0.5275		0.5319		0.5342		0.5197		0.6308	
R-sq overall	0.5271		0.5262		0.5265		0.5221		0.537		0.5957	
Wald chi2(4)	149.17		154.02		151.89		145.98		169.06		161.17	
Prob > chi2 =	0.0000		0.0000		0.0000		0.0000		0.0000		0.0000	
Groups	13		13		13		13		13		13	
N	130		130		130		130		130		130	
LM test (Var(u) = 0):												
chibar2(01)	39.55		39.87		38.95		38.6		39.6		49.66	
P>chibar2(01)	0.0000		0.0000		0.0000		0.0000		0.0000		0.0000	
Hausman test:												
chi2(4)	155.51		251.22		225.08		188.38		233.03		-88.17	
Prob>chi2	0.0000		0.0000		0.0000		0.0000		0.0000		fitted model	
	(V_b-V_B is not positive def.)		(V_b-V_B is not positive def.)		(V_b-V_B is not positive def.)		(V_b-V_B is not positive def.)		(V_b-V_B is not positive def.)		fails Hausman	

Regardless of the estimation procedure, the results from our pooled cross-section remain consistently show the expected positive significant relationship with the size of the economy (approximated by the share of employment *s_empl*), a negative relationship with the share of agricultural activity, and an always significant and positive (when corrected for the estimation biases) relationship with the share of human capital. These results both agree with standard economic thinking and confirm the structural dependence of the economic prosperity of the Greek regions. Regarding the cultural variables, they are all highly significant, especially the multi-dimensional CBD recommended variable *CC* and the cultural heritage fixed characteristics (approximated with *jew5*). More specifically, it seems that the Greek urban centres which have high productivity levels have attracted people who have relatively lower levels of trust. This result also suggests that the Putnam hypothesis of cultural impacts on local development is also relevant for Greece, even if in a somewhat surprising direction. Yet, while it is typical for the city to have lower levels of trust and to experience lower social cohesion and cooperation in comparison to the village, this indicator still does not seem to be the most statistically powerful cultural indicator. Those indicators are the negative influence of the share of people with a negative attitude to new ideas and the share of people with a negative attitude to innovation, which always register the highest and most significant levels (among the individual cultural variables) of negative impact on local economic productivity per worker in Greece. These results seem to be in agreement with the CBD claim that local culture and local innovation potential and economic development are related in a percolation chain (see the previous results for the EU15 in Tubadji and Nijkamp

(2015b)). Namely, the localities where people with a low level of trust are gathered experience negative cultural effects on their productivity due to the low trust that acts as a barrier for the percolation of new ideas and innovation. Thus, the urban centres of Greece suffer lower productivity due to the cultural barrier for innovation.

Operationally, our results also support the CBD recommendation to use a multi-dimensional variable *CC* to approximate local cultural attitudes per se. When using the *CC* variable, the amassed variance of the individual cultural variables taken together registers a much higher statistical predictive power for the cultural factor in the Greek regions. Moreover, with this aggregate measure *CC*, we see clearly that the aggregate cultural impact from the different individual cultural variables is finally negatively associated with local productivity. The CBD approach thus facilitates a statistical estimation of the culture-related impact indicator, which, as an economic interpretation, agrees with the preceding, indirectly obtained, conclusions based on the results from the various individual cultural variables. Moreover, the *CC* variable, which approximates living culture and reflects current local attitudes, and the cultural heritage approximation *jew5* both have a similar statistical significance, which further reinforces the CBD-oriented conceptualization. In the particular case of Greece, we also see that the cultural heritage variable *jew5* and the living culture variables (specifically *CC*) have the same direction of impact. From a CBD perspective, this result can be explained as a confirmation of a long-lasting cultural closedness towards innovation and being different, which is negatively related to local economic productivity and the overall development of Greece at the regional level. This result is particularly interesting, as it indicates that the cultural factor is indeed relevant when trying to disentangle the current socio-economic problematic development of this country which is otherwise rich both culturally and historically. The cultural heritage variable, however, remains strongly significant, but the sign of influence changes compared with 2002 for the pooled cross-section. This may occur because it is a fixed characteristic in the pooled data set, and also because of the small number of observations in the descriptive results for 2002. But, in general, this historic indicator remains clearly significant throughout the different approaches. This result should be interpreted with caution, yet the significance of this particular variable may be an interesting indication of a cultural persistence effect in the Greek regions. This deserves a more thorough and in-depth analysis in future research. Also, especially given the fact that the traditional variable religion is not very suitable for investigating inherited cultural attitudes in Greece, such a historic variable that captures the local attitudes in the milieu should be given due attention based on its reported highly significant coefficients.

Finally, as noted in our estimation strategy section, the standard LBI/BNF, LM, and Hausman tests for pooled cross-section estimations were conducted. Both the modified Durbin-Watson estimator and the Baltagi-Wu LBI estimator are below 2 (see Table 3b). Thus, in the fixed-effect estimations we still have strong indications for serial correlation, and therefore the fixed-effects results should be interpreted with caution. According to the LM test, the random effects estimations are much more reliable compared with our beta-coefficient estimations in Table 3a. Yet, the comparison between fixed and random effects estimates, provided by the Hausman test, still cautions us about the availability of some fixed effects, which are eliminated only with the use of our cultural heritage fixed characteristics.

To triangulate the statistical reliability of our results, we conducted the same estimations but with a reduced pooled data set, using only the directly available observations for the years 2002, 2004, 2006, and 2008. The results appeared to be consistent. Finally, we performed a GMM Arellano-Bond (1991) estimator exploration of the pooled data set, which also confirmed our results. Clearly, the data set is rather small for the powerful statistical apparatus of GMM, and we therefore refrain from presenting these results here as our main contribution. Still, it is an important positive sign for our results that this small pooled data set performs consistently in response to all methodological approaches attempted with it.

4. Conclusion

The results from the empirical testing of our main hypothesis clearly support the claim that in Greece the regional economic disparities are strongly related to the intangible cultural capital in the locality. The cultural differences in the context of negative cultural attitudes towards ideas and innovation and overly traditional views strongly affect the developmental pattern throughout the country. Human capital and cultural milieu disparities turn out to be somewhat interconnected in their effects, because when a stationary situation is considered by the 3SLS model, human capital is found to play a major role. The data limitations hold true for our 3SLS models, but these

results also remain reasonably consistent over all experimented approaches and specifications, which, according to the method of triangulation, is a positive sign for their reliability. In addition, a more statistically powerful exploration with a pooled cross-section provides more evidence on the relationship between culture and local productivity in the Greek regions.

Our results consistently support a Putnam and predominantly CBD-motivated hypothesis for a cultural impact on local productivity through local cultural attitudes (such as social capital or attitudes to innovation and ideas). The CBD operational recommendations for the approach to quantifying the cultural variable as a multi-dimensional factor also find support in our analysis. Also, most interestingly, indications of cultural persistence effects are hinted at by the best performance of the historical intangible cultural capital variable in our data set. This is a reason to believe that other economic history effects might also be identified as factors for local development in Greece, and this aspect is worth further exploration.

In conclusion, as both the main CBD theoretical and empirical claims find confirmation in our results, this suggests that generally our working hypothesis seems to find support in the presented results. In particular, this means: (i) the structure of the mechanism of intangible cultural impact is confirmed by our descriptive results in Greece as a two-gear-mechanism, centred around the concentration of human capital, while the effect of culture on local productivity is reported by our pooled cross-section estimations as a highly statistically significant relationship; and (ii) intangible cultural capital is most successfully approximated by a vector variable which aggregates local attitudes. This vector variable outperforms the individual attitudes as proxies of cultural capital.

Consequently, our tentative exploration of the impact of intangible cultural capital in Greece indicates that CBD is a relevant framework for explaining regional discrepancies in Greece, a finding previously established for other countries. It is especially noteworthy that, in analyzing the Greek case of local development, the cultural heritage intangible variable was found to be an important factor in the context of the analysis of the current economic crisis of Greece. This finding is not only consistent with the CBD-related findings for other countries (e.g., Germany), but also merits further exploration in line with modern cultural persistence studies in the context of Germany (see Satyanath et al. (2013)).

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Appendix 1. Culture-based Development Mechanisms of Impact of Cultural Capital on Local Development.

The cultural capital of an individual tends to change when the individual changes geographical location, and vice versa. Therefore, the migration of people transforms the living culture of the localities. Moreover, individuals and places are also latent carriers of the path dependence of the mother-place on its historic track record of unique local cultural capital formation. Therefore, though the change in living culture is endogenous to migration processes, the cultural factor itself remains uniquely independent of the present moment because it is a function of a Polya type of process, where the changes in the present are dependent on a series of changes from the past. All this defines culture and its transformation over time. Next, this input-oriented local cultural capital (after being shaped through history and migration) gets plugged into the production process through a unique, complex but clearly-structured mechanism. This is the mechanism of culturally-biased preference, which penetrates human choice on all its levels regarding the selection of inputs and their recombination, the consumption not only of ethnic goods but also the overall consumption in the locality and the reallocation of resources within the locality and throughout localities through financial investments and trade. What is pivotal in this process is that the aggregate impact of local cultural capital on local productivity takes place through the impact of culture on the individual and her/his location choice. The cultural impact on the individual is partially predetermined by place of birth (where local cultural capital shapes the human capital in a Weberian sense). Yet, at a second stage, the locally-shaped human capital can relocate through self-selection. This relocation process is crucial for the reshaping of local culture through diversity processes. Moreover, it shapes the cultural milieu and performs spatial sorting of the elements which are identical in human capital and cultural compatibility, in a sense even broader than Axelrod's mechanism suggests. This broader sense of CBD based on culture and human capital-sensitive spatial self-selection is called 'cultural gravity'. Namely, at a particular moment t-m, a locality invests in its human capital. In time t-n, where n<m, the locality has lost some of its human capital due to an outflow of migrants, and has also attracted some immigrants for reasons concerning both economic and cultural amenities. In moment t, which is the present moment, the locality possesses cultural capital which is a combination of the path-dependencies of its incumbent and inflowing individuals. This unique cultural capital is characterized by the cultural distances between the individuals composing its aggregate diversity. The magnitude of the effect that it will generate depends on the openness or closedness of the cultural milieu in this locality towards change and otherness. Based on these characteristics and their interaction, a cultural gravity effect is created, which means that what determines economic welfare – together with the local economic incentives – is the past and recent reallocation of human capital and cultural capital through space.

Appendix 2. Cultural Indicators from the ESS.

This paper measures local cultural capital by using data on attitudes reported in the ESS, which takes place on a biennial basis, for the period 2000–2006. Our four categories of cultural indicators are informed by the ESS as follows: attitudes of lowest level of trust (in the ESS: the variable 'ppltrst'); negative attitude to innovation (in the ESS: 'ipcrtiv'); negative attitude to creativity and new ideas (in the ESS: 'impdiff'); and a high level of traditionalism (in the ESS: 'imptrad'). Answers are ranked from 1–10, a strong positive association indicating smaller numbers. The answers with codes 1 and 2 were considered in order to extract the share of those with highly positive attitudes. The variables forming CC were calculated based on the difference between the number of locals and the number of those with highly positive cultural attitudes. As the data are on a biennial basis and 2004 does not provide representative information for Greece, the yearly data were artificially recovered by assuming that the development of culture in the periods between the known levels of cultural attitudes behaves as a linear function. In other words, by plotting the level of cultural attitudes as a development over time, where the x axis represents time, we connected the known levels of cultural capital with lines and calculated the value for the missing years by finding on the lines the particular point for which the particular missing year is represented by an orthogonal projection on the axis.

Appendix 3. Post-Estimation Tests.

Our LBI/BNF tests serve as a check for evidence of correlated errors over time inside the pooled data set. The procedure for the LBI test identifies the Baltagi-Wu as the locally best invariant (LBI) test statistic with the null hypothesis that rho = 0. The modified version of the BFN-Durbin-Watson statistic (Bhargava et al., 1982) serves to test the OLS residuals from a fixed effects model for serial independence. The main rationale behind the LBI and BFN (though the latter might have an upper and lower bound) is that, if these test statistics report a value less than 2, this indicates positive serial correlation.

The LM Test is basically a test for random effects, namely the Breusch-Pagan Lagrange Multiplier (LM). This LM test helps us decide between a random effects regression and a simple OLS regression. The null hypothesis of this test is that the variance across entities is zero. If this holds true, it means that no significant differences across units (i.e., no panel effects) are detectable. The procedure involves running a xttset0 command, right after running the random effects model with xtreg. If Prob>chi2 is not significant, we fail to reject the null hypothesis and conclude that the random effects assumption is not appropriate. That is, there is no evidence of significant differences across countries, and therefore a simple OLS regression can be run instead.

The Hausman test is used to decide between fixed or random effects. Its null hypothesis is that the preferred model is based on random effects. The rationale behind the test is to check whether the unique errors (u_i) are correlated with the regressors, and the null hypothesis assumes that they are not. The procedure that we follow is that we first run a fixed-effects model and save the estimates, then we run a random-effects model and save the estimates, and finally we perform the test. If Prob>chi2 is < 0.05 (i.e., if it is significant), we can conclude there is evidence for fixed effects in our data.