Multidimensional creativity as a mediator between cultural heritage and regional economic development in England

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Scientific Report prepared for Historic England

1. Executive summary

- Cultural heritage has been widely recognized as a possible determinant of economicdevelopment. Apart from the well-known mechanism which sees cultural heritage as an attractorof tourism, the present report puts forward the idea that there could be some more sophisticatedand intangible channels through which such territorial resource could positively affect local economic development. In particular, a potential *inspirational* role of cultural heritage on (multidimensional) local creativity and its subsequent favourable effect on economic development is here suggested.
- Within the present report, cultural heritage is considered as immovable and tangible, according to the belief that impressive material elements of cultural heritage are also representative of intangible meanings, such as history, traditions, sense of belonging and civic proud.
- Creativity is here conceptually defined as *ideation based on talents of different types, i.e. stemming from different domains*. It is in fact a multidimensional territorial characteristic, generated by the interplay of three different creative talents: artistic, scientific, and economic.
- The linked relationships from cultural heritage to (the different types of) creativity and from (multidimensional) creativity to development in the NUTS3 regions of England are econometrically investigated.
- **Cultural heritage seems to be effectively exploited in England** and in fact it comes out to have a positive direct impact on economic development (this being possibly related to tourism). It is also **a significant determinant of economic creativity**. The three types of creative talents, however, do not seem to have a relevant effect on GDP growth when considered individually.
- While artistic and scientific creative talents do not appear to play any significant joint role in affecting economic development in England, when they are interacted with economic creativity it clearly emerges how **the regions that are abundantly endowed with both economic creative talent - on the one hand - and with either scientific or artistic creativity - on the other – perform better in terms of GDP growth**.
- Therefore, **cultural heritage seems to enhance economic development both directly and through its role in inspiring economic creativity**. For instance, the presence of tangible and immovable cultural heritage can stir up related entrepreneurial and business ideas.
- It is extremely important to raise awareness on **cultural heritage as an effective tool for enhancing economic performance**, and not only as a burden to be bore just because of "moral" concerns.

[1] Comments and suggestions provided by Roberta Capello (Politecnico di Milano) are gratefully acknowledged.

2. Introduction

Cultural heritage is a significant force for 21st century Europe, being nowadays recognized by both governments and citizens as an enhancer of economic performance, living environments and people's lives, sense of history, identity and belonging (European Commission, 2015).

In fact, although traditionally the economic impact of cultural heritage had been merely associated to (cultural) tourism, its role as a trigger of more intangible and sophisticated mechanisms sustaining regional performance is by now widely accepted.

Della Torre (2010), for instance, explains how it is fundamental to overcome the basic belief that heritage counts just because of its impact on the tourist economy, stressing that cultural heritage can be a relevant driver of curiosity and of the capability to doubt, to learn and to innovate. In addition, cultural heritage can be a relevant driver of critical thinking and its impact on economic development is magnified by the intangible cultural elements that characterize the place where it is located (Capello and Perucca, 2017). Cultural heritage can indeed play an essential role in local development, leading to a sense of belonging and identity[2].

In particular, the type of cultural heritage considered here is immovable and tangible, according to the idea that material elements are the tangible expression of the local history, traditions and socio-political context (Spagnolo, 2019). Therefore, they are also representative of non-material meanings, such as identity, sense of belonging, collective memory and civic pride (Carta 1999).

The idea proposed in this report is that cultural heritage can have a positive impact on economic development through creativity, which can in fact be triggered by feelings and thoughts inspired by the exposure to the physical presence of impressive elements of cultural heritage. In this sense, cultural heritage could positively affect development in a more creative environment.

As for local creativity, it is here considered as *multidimensional*. In more details, three different types of creative talents are identified within the present work, namely:

- artistic creativity (art/culture based, involving imagination and mainly expressed through text, sound, dance and images. See also UNCTAD 2010);
- scientific creativity (science-based, involving curiosity and willingness to make new connections in problem solving. See also UNCTAD 2010), and
- economic creativity (related to entrepreneurial skills and expressed mainly through new business ideas).

The different types of creativity do interact at the territorial level, generating peculiar kinds of local creative specialization. This report stresses in fact the importance of *synergy* between different creative talents, according to the idea that it is through their interplay that the most original and innovative ideas are generated. This mechanism can be seen indeed as a trigger and an enhancer of local economic development.

Therefore, local creativity is here defined as *ideation based on talents of different types, i.e. stemming from different domains*[3].

According to the conceptual framework described above, the idea explored within the present work is that cultural heritage can *inspire* local creativity, which in turn is expected to have a positive impact on economic development through triggering the production of new and original ideas.

[2] See also Camagni et al. (2020).

[3] For a thorough description of the different creative talents and for the conceptual framework on multidimensional local creative specialization the reader can refer to Cerisola (2018a).

This report is structured as follows: Section 3 briefly sketches the present debate on cultural heritage and local development, while Section 4 presents the methodology, and Section 5 displays the results, which are discussed in Section 6. Finally, Section 7 concludes.

3. Present debate on cultural heritage and local development

A large debate exists today on the cultural heritage–development nexus on the one hand and on the creativity-development nexus on the other. The present work tries to combine these two perspectives drawing conceptually and methodologically on some previous works carried out by the author, based on the idea that cultural heritage can positively affect economic development also through sophisticated and intangible channels, one of them being creativity.

As for cultural heritage and its impact on economic performance, although different transmission mechanisms between cultural heritage and economic development have been theoretically identified (see Ashworth, 2013; CHCfE 2015), the role played by cultural heritage has been seen more in terms of tourist attraction (e.g. European Council, 1999 and 2014, Greffe 2009, Snowball 2013) than of innovation stimulator. Within this framework, a relatively scant amount of empirical works emerges (e.g. Yang et al. 2010 and Patuelli et al. 2013) with mixed outcomes (see Cellini, 2011), while a positive relationship between cultural heritage and development is often just assumed.

As for the link between creativity and economic performance, also at the academic level, there is nowadays a rich empirical literature available. This is mainly based on two different approaches to the measurement of creativity: the *industry-based* one and the *occupational* one. The first rests on the identification of so-called *creative industries* and the subsequent quantification of their employment and/or value added, while the second – mainly associated to Richard Florida's work - involves the number of people who perform creative tasks (Florida's "creative class"). Following the *industry-based* approach, some authors highlight a positive impact of creativity on wealth (Boix et al., 2013) and on labour productivity (Boix-Domenech and Soler-Marco, 2017). Many more works, however, focus on the *occupational* approach to creativity and point out how the "creative class" positively affects wages (Florida et al. 2008), productivity growth (Marrocu and Paci, 2012 and 2013), or employment growth (Marlet and Van Woerkens 2007, McGranahan and Wojan 2007, Boschma and Fritsch 2009).

Starting from the two points of view presented above, this report aims at getting a better understanding of the impact of cultural heritage on economic development, possibly also through its effects on creativity, which - in turn - is expected to play a positive role in regional performance, being recognized as an engine of economic and social innovation. In fact, already in 2007, the European Commission highlighted the importance of promoting culture as a catalyst for creativity and KEA (2009) also conceptually explored the link between the two elements.

As per our knowledge, however, the first empirical check of this mechanism was provided by Cerisola (2019a and 2019b), who analysed Italian provinces taking into account the *inspirational* impact of tangible immovable cultural heritage on artistic, scientific, and economic creative talents and, in turn, the effect of the synergic interaction between different types of creativity on economic development.

The present study applies the same theoretical and methodological framework to the NUTS3 regions of England, providing new and interesting insights within the topic.

4. From cultural heritage to development through creativity: methodology

4.1 The econometric model

The aim of this study is to provide a comprehensive approach that shows both the direct impact of cultural heritage on local development and its indirect effect through the mediation of (different types of) creativity that can interact, possibly generating the most original, innovative and development-enhancing ideas, thusenhancing the local economic performance.

In order to do this, the linked relationships from cultural heritage to creativity and from creativity to development were econometrically explored according to the following specification[4]:

(1a) $\Delta gdp_{i;(t+5)-t} = \alpha + \beta_1 artistic\ creativity_{i(t-1)} + \beta_2 scientific\ creativity_{i(t-1)} + \beta_3 economic\ creativity_{i(t-1)} + \beta_4 cultural\ heritage_{i(t-1)} + \beta_5 X_{i(t-1)} + \beta_6 london + \beta_7 time + \beta_8 D_i + \varepsilon_{it-1}$

(1b) $artistic\ creativity_{i(t-1)} = \alpha + \beta_1 cultural\ heritage_{i(t-6)} + \beta_2 diversity_{i(t-6)} + \beta_3 Z_{i(t-6)} + \beta_6 london + \beta_7 time + \beta_8 D_i + \varepsilon_{it-6}$

(1c) $scientific\ creativity_{i(t-1)} = \alpha + \beta_1 cultural\ heritage_{i(t-6)} + \beta_2 diversity_{i(t-6)} + \beta_3 Z_{i(t-6)} + \beta_6 london + \beta_7 time + \beta_8 D_i + \varepsilon_{it-6}$

(1d) $economic\ creativity_{i(t-1)} = \alpha + \beta_1 cultural\ heritage_{i(t-6)} + \beta_2 diversity_{i(t-6)} + \beta_3 Z_{i(t-6)}\ \beta_6 london + \beta_7 time + \beta_8 D_i + \varepsilon_{it-6}$

where, in equation (1a), *Δgdp* is the average annual (compound) real GDP growth rate in the NUTS3 regions of England[5] (*i*) in two periods, 2007-2012 and 2012-2017. *Artistic, scientific* and *economic creativity* are the explanatory variables of interest and represent different creative talents. *Cultural heritage* is also an important regressor and measures the degree of residents' exposure to tangible cultural heritage. *X* is the usual vector of other variables controlling for additional elements that are expected to affect regional economic growth, in particular:

- *innovation*, since its role in regional development is widely recognized in the existing literature (e.g. Lim 2003, Bauer et al. 2012, Stephens et al. 2013);
- *human capital (tertiary education)*, since it is a universally accepted critical element in economic growth and favors innovation. In addition, it is particularly important to include it in our regressions because it tends to be very much correlated (and confused) with creativity (see Glaeser 2005);
- *settlement structure (population density)*, to take agglomeration and urbanization economies into account;
- *total population*, to control for size;
- *per capita GDP*[6] to consider the initial level of wealth; and
- *share of employment in manufacturing*, to check for the industrial vocation of the area.

Finally, *london* is a dummy variable equal to one if the area is located within London administrative borders and it is meant at controlling for the strong effects related to the presence of such a big metropolitan area, characterized by very different features with respect to most other regions in England.

[4] Structural equation modelling (SEM) was chosen as the most appropriate technique to econometrically investigate the research question since it allows to provide a comprehensive econometric model that shows the role of creativity as a mediator/catalyser between cultural heritage and economic development. In this sense, the model is meant to show the impact of cultural heritage on the different creative talents (artistic, scientific and economic) and the subsequent impact of such creative talents on regional economic development (see also Cerisola 2019a, Ch. 7). In more details, the estimation was carried out through a Generalized Structural Equation Model (GSEM), since this allows to better accommodate interacted terms.

[5] The NUTS classification (Nomenclature of territorial units for statistics) is a hierarchical system for dividing up the economic territory of the EU and the UK for the purpose of collecting, developing and harmonising European regional statistics; providing socio-economic analyses of the regions and framing EU regional policies. The NUTS3 level, in particular, represents small regions for specific diagnoses (https://ec.europa.eu/eurostat/web/nuts/background, accessed 23 November 2020).

[6] The values of per capita GDP at NUTS3 level in England are biased by the presence of London that, due to an overall much higher level of production and relevant commuting flows, tends to provide unreliable information. For this reason, the level of per capita GDP was included in the regression at the NUTS2 level.

Time and regional (NUTS2[7]) fixed effects are also included and each growth period is explained through independent variables referring to the previous year, namely 2011 and 2006. This is done to take the appropriate time consequentiality into account and to limit endogeneity, following the idea that *previous* conditions affect *subsequent* outcomes according to a *causality* perspective (as much as possible).

As for sub-equations (1b) – (1d), *artistic, scientific* and *economic creativity* are in turn explained[8]. The main variable of interest is residents' exposure to *cultural heritage*, to catch if in fact there is an inspirational effect at play, leading from cultural heritage to (different types of) local creativity.

In addition, *diversity* is also considered, since it is deemed to generate creativity both because it attracts creative talents thanks to a tolerant environment (e.g. Florida 2002 and 2003, Florida and Gates 2011) and because it provides fertile ground for the interplay of different ideas, approaches and perspectives (e.g. Andersson 1985, Florida 2002, Baycan-Levent 2010).

Subsequently, *Z* is a vector of other variables controlling for additional elements that are expected to affect regional creativity, namely[9]:

- *human capital*, in terms of talent/education (e.g. Florida 2002, Crociata et al. 2018);
- *settlement structure (population density)*, since urbanization economies favour direct relationships and face-to-face interactions and exchanges of thoughts, ideas and experiences (e.g. Andersson et al. 1993, Bradford 2004, Landry 2008);
- *total population*, to control for size;
- *per capita GDP*, according to the idea that in order to "afford" to be creative a region must have reached a certain level of economic well-being (e.g. Csikszentmihalyi 1996, Crociata et al. 2018); and
- *share of employment in manufacturing*, to check for the industrial vocation of the area.

Finally, as explained above, dummy *london* controls for the presence of the big metropolitan area and time and regional (NUTS2) fixed effects are also included. Each creative talent is explained by 5-years lagged independent variables (thus referring to 2006 and 2001). Since Census data (see next sub-section) are available for 2001 and 2011, values for 2006 were obtained through linear interpolation. This was made necessary because data earlier than 2000 are not available and otherwise the correct temporal consequentiality would not be respected (see also before).

Three additional structural equations are exploited to expand the model, considering the two-way interactions between different creative talents, since we do expect synergies between different types of creativity to positively affect regional development.

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[7] The computational power of the model and the number of observations do not allow to include the regional fixed effects at NUTS3 level.

[8] On the different determinants of creativity, the reader may refer to Cerisola (2018b).

[9] Logistic accessibility could also affect stakeholders' engagement with cultural heritage and consequently its impact on local creativity and economic development. Unfortunately, suitable data for controlling for this effect are not available at the moment.

[10] Grade I buildings are of exceptional special interest; Grade II* buildings are particularly important buildings of more than special interest; Grade II buildings are of special interest, warranting every effort to preserve them (DCMS 2018, accessed 3 July 2020 at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/757054/Revised_Principles_of_Selection_2018.pdf). Data kindly provided by Historic England.

Data sources and measurement methods are thoroughly described in the next sub-section.

4.2 Data and measurement methods

The data used in the present report represent a significant step forward with respect to the existing related works. On the one hand, Census data were available at a very detailed level in terms of geographical, occupational, and sectoral disaggregation. On the other hand, Historic England provided extremely useful data not only on the physical presence of tangible cultural heritage, but also on its special architectural and historic interest (*grading*).

The dataset was built at NUTS3 level. Such level of spatial disaggregation can be considered particularly appropriate since it is quite detailed, but still allows to consider our territorial perspective because it involves a whole region characterized by specific tangible and intangible features (see the concept of *territorial capital* in OECD 2001, European Commission 2005, Camagni 2019).

The variables, together with details on their computation and sources, are described in Table 1. As explained in the previous sub-section, the main variables of interest are those representing *cultural heritage* and the three different types of *creativity* devised within this work.

As for cultural heritage, NUTS3 level data on the number of *listed buildings*[11] were kindly provided by Historic England and the absolute values were weighted by area in order to obtain an indicator representing the residents' degree of exposure to tangible cultural heritage.

Table 1 – Variables' description

Variable	Measure	Computation	Year	Source
Avg GDP growth	Economic development	Average annual (compound) real GDP growth	07-12; 12-17	Eurostat
Cultural heritage	Exposure to cultural heritage	Listed buildings/thousand km^2	2001; 2006; 2011	Historic England
Artistic creativity	Creativity related to emotional expression, imagination, art, and culture	people performing creative tasks in artistic sectors/total employment (see footnote 11 for further details)	2006; 2011	Office for National Statistics
Scientific creativity	Creativity related to science, research, and analytical problem solving	people performing creative tasks in scientific sectors/total employment (see footnote 11 for further details)	2006; 2011	Office for National Statistics
Economic creativity	Creativity related to economic organization, business ideas, and entrepreneurship	No. of trademarks for thousand residents	2006; 2011	Eurostat
Manufacturing	Industrial vocation	Share of the employment in the manufacturing sector	2001; 2006; 2011	Eurostat

[11] *Listed buildings* are buildings of special architectural or historic interest (DCMS 2018, accessed 3 July 2020 at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/757054/Revised_Principles_of_Selection_2018.pdf). They may include great cathedrals, houses, but also more modest but still fascinating structures.

Settlement structure (Population density)	Urbanization economies	population per km^2	2001; 2006; 2011	Eurostat
University graduates	Human capital	Share of graduate employees	2001; 2006; 2011	Eurostat (CensusHub)
Patents per resident	Innovation	No. of patents per thousand residents	2006; 2011	Eurostat
Population	Size	Number of residents	2001; 2006; 2011	Eurostat
GDP pc	Wealth	GDP/population	2001; 2006; 2011	Eurostat
Share foreign born population	Diversity	Foreign born/total population	2001; 2006	English Office for National Statistics

As for creativity, as highlighted in Section 3, there are in fact two main approaches to the measurement of this intangible and elusive concept: the *creative industries* approach and the *occupational* approach[12]. Both present some weaknesses, the *creative industries* one also including people who do not perform creative tasks and the *occupational* one, although able to discern "creative people", often encompassing too many workers. In addition, both methods are based on an *ex ante* (and somehow discretionary) selection of what sectors or occupations can be deemed creative.

Since the *occupational* approach to the measurement of creativity in fact overcomes some of the limits of the industrial approach, the former is here considered as the starting point for quantifying artistic and scientific creativity, also trying to include some sectoral considerations. Drawing on county-level Census data[13], indeed, *artistic creativity* is measured as the share of people performing creative tasks in artistic sectors and *scientific creativity* as the share of people performing creative tasks in scientific sectors over total employment[14]. Finally, *economic creativity* is measured as trademarks applications per capita, being trademarks an expression of new and original business ideas.

5. Results

The results obtained through the estimation of the models described in the previous section are graphically summarized in Figure 1 (a-d) for the overall impact of cultural heritage on the different creative talents and the subsequent effect of (multidimensional) creativity on economic development.

The full results with all the details on control variables are instead displayed in Annexes 1 (a-d) and 2 (a-b).

As can be seen from Figure 1a, cultural heritage has a positive direct impact on economic development and is also a significant determinant of economic creativity. The three types of creative talents, however, do not seem to have a relevant effect on GDP growth when considered individually.

[12] For a measurement method that tries to consider both perspective the reader can refer to European Commission (2016).

[13] County-level data do not correspond exactly to the NUTS3 disaggregation. Therefore, some county level data had to be aggregated in order to get the NUTS3 value. In addition, in some cases data were provided at a more geographically aggregated level by the National Statistical Office, due to privacy reasons. In these cases, the data were distributed among the related NUTS3 regions according to their population.

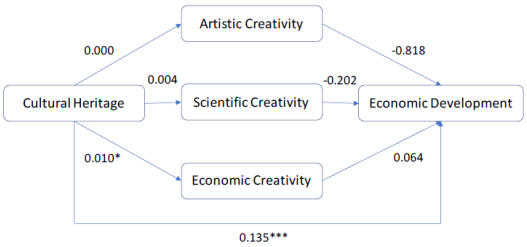
[14] In more details, *artistic creativity* is measured as the share of professional occupations in "artistically creative" sectors (Motion picture, video and television programme production, sound recording and music publishing activities; Programming and broadcasting activities; Creative, arts and entertainment activities; Libraries, archives, museums and other cultural activities) while *scientific creativity* is measured as the share of professional occupations in "scientifically creative" sectors (Computer programming, consultancy and related activities; Architectural and engineering activities; technical testing and analysis; Scientific research and development; Advertising and market research; Other professional, scientific and technical activities).

Figures from 1b to 1d graphically display a deepening of the overall reasoning, i.e. the exploration of the synergic effect of different types of creativity. While artistic and scientific creative talents do not appear to play any significant joint role in affecting economic development in England (Figure 1b), when they are interacted with economic creativity it clearly emerges how the latter catalyzes the impact of artistic and scientific creative talents on economic development. The regions that are abundantly endowed with both economic and scientific creative talents (Figure 1c) and with both economic and artistic creative talents (Figure 1d) perform better than the others in terms of GDP growth (see Annex 3 for the graphical representations of these relationships).

Therefore, cultural heritage seems to enhance economic development both directly and through a more sophisticated and intangible channel, i.e. through its role in determining (inspiring) economic creativity.

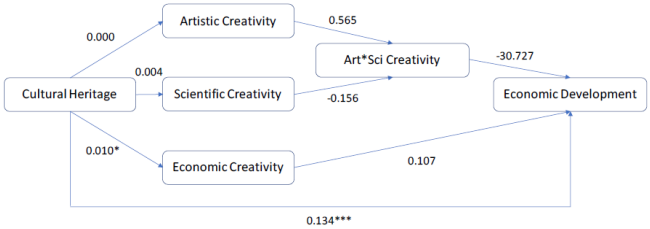
Figure 1 – From cultural heritage to development through creativity

1a) Single creative talents



*Significance as follows: ***1%, **5%, *10%.*

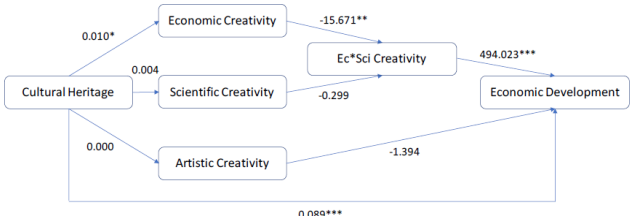
1b) Synergy between artistic and scientific creativity



0.134***

*Significance as follows: ***1%, **5%, *10%.*

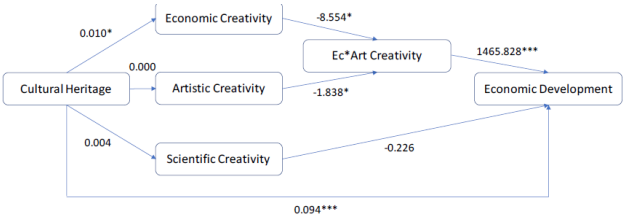
1c) – Synergy between economic and scientific creativity



0.089***

*Significance as follows: ***1%, **5%, *10%.*

1d) Synergy between economic and artistic creativity



0.094***

*Significance as follows: ***1%, **5%, *10%.*

6. Discussion of the results

The results reported in the previous section are extremely interesting and overall show that cultural heritage in England is effectively used under an economic perspective (positive and significant direct impact on GDP growth), but also that other more intangible and sophisticated transmission channels are important in putting in context the impact of cultural heritage on economic development.

In particular, cultural heritage came out to be a determinant of economic creativity, which in turn – when interacting with artistic and scientific creativity – favours economic development. **This means that regions in which abundant economic creativity is accompanied by rich artistic or scientific creative talents grow more than the others** (see Annex 3).

All in all, in England scientific and (even more so) artistic creative talents look extremely concentrated in London area and agglomeration economies (population density) appear in fact quite important. As for diversity in terms of share of foreign-born population, it seems to negatively affect artistic and scientific creativity. This is not in line with our theoretical expectations, but could be due to the measure used, which includes only one specific dimension of diversity and in fact does not include the foreigners' level of skills anyhow[15]. Future research could aim at better detailing this particular determinant. On the other hand, however, diversity comes out to affect significantly economic creativity. This is very much consistent with some previous literature on entrepreneurship (e.g. Audretsch et al. 2010 or Nathan and Lee 2013) and with Cerisola (2019a and 2019b).

As expected, human capital has a strong positive and significant impact on artistic and scientific creative talents, while it does not seem to affect economic creativity, which is in fact more related to business ideas and entrepreneurial capacity and more independent of formal education[16].

7. Conclusions

The work showed the relevance of cultural heritage in stimulating economic development in England, also through some innovative, intangible and sophisticated mechanisms, such as local creativity. The presence of cultural heritage, in fact, came out to be a determinant of economic creativity that in turn, when synergistically interplaying with either artistic or scientific creative talents, exerts a positive effect on regional growth. In other words, regions where economic creativity is abundant and concurrently present with either artistic or scientific creative talents perform better than the others.

[15] High-skilled immigrant flows can improve human capital and the stock of ideas in the host country (Kerr and Lincoln 2010, Hunt and Gauthier-Loiselle 2010). See also Akcigit et al. (2017).

[16] The impact of human capital on scientific creativity is so strong and the variable so much correlated with wealth that the variable measuring gdp per capita turns significantly negative. When human capital is removed from the equation, in fact, gdp per capita becomes positive and extremely significant.

However, artistic and scientific creativity seem to be very much concentrated in London area. From a policy perspective, trying to reinforce the presence of these creative talents also across the other regions of England could work to improve the effect of cultural heritage on development through creativity.

Overall, the potential of cultural heritage for being a resource for economic growth in England has clearly emerged. In fact, it was shown how it can positively affect regional economic growth also by triggering (economic) local creativity. Therefore, it seems to be extremely important to raise awareness on cultural heritage as an effective tool for enhancing economic performance, and not only as a burden to be bore just because of "moral" concerns.

Moreover, **territories may implement policies for strengthening the role of cultural heritage in enhancing their growth, mainly supporting the participation and the engagement of the local stakeholders**. This is particularly relevant in the current period, when such policies could also be used as a valid instrument for supporting regional resilience after the covid-19 global crisis.

Some future developments of the present research work could possibly include the engagement of the local stakeholders, since it can stimulate individuals on emotional, physical and intellectual levels (and also promote social capital formation). In fact, "activating" cultural heritage through the involvement of residents could provide additional emphasis on its effect on development[17].

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[17] Some data on engagement with cultural heritage are available through the "Taking Part" Survey carried out by the DCMS. Unfortunately, the sample is statistically representative only at the national level and the information is available only for a few points in time. Therefore, we were not able to use those data within the present work.

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9. Appendix

Annex 1- From cultural heritage to development through creativity

Table A1a - From cultural heritage to development: single creative talents

	Structural Eq. GDP growth	Artistic Creativity	Scientific Creativity	Economic Creativity
	(1)	(2)	(3)	(4)
artistic creativity	-0.818			
	(1.169)			
scientific creativity	-0.202			
	(0.219)			
economic creativity	0.064			
	(2.495)			
cultural heritage	0.135***			
	(0.043)			
human capital	0.045*			
	(0.024)			
population density	0.000**			
	(0.000)			
GDP per capita	-0.039			
	(0.038)			
innovation	-4.308			
	-14.397			
manufacturing	0.026			
	-0.024			
population (size)	0.000			
	(0.000)			
london	0.003	0.002***	0.009***	-0.0000
	(0.005)	(0.000)	(0.002)	(0.000)
GDP per capita $_{t-6}$		0.004	-0.055***	0.005
		(0.006)	(0.018)	(0.004)
cultural heritage $_{t-6}$		0.000	0.006	0.010*
		(0.007)	(0.011)	(0.005)
diversity $_{t-6}$		-0.006***	-0.022***	0.003***
		(0.001)	(0.006)	(0.001)
human capital $_{t-6}$		0.011***	0.081***	-0.001
		(0.001)	(0.011)	(0.001)
population density $_{t-6}$		0.000***	0.000	-0.000**
		0.000	0.000	0.000
population (size) $_{t-6}$		0.000	0.000**	-0.000***
		0.000	0.000	0.000
manufacturing $_{t-6}$		0.003***	0.012**	0.000
		(0.001)	(0.006)	(0.000)
Regional FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
constant	-0.003	-0.002***	-0.006**	0.000

	(0.007)	(0.000)	(0.003)	(0.000)
No. of observations	264	264	264	264

*Robust standard errors in parentheses. Statistical significance as follows: ***1%, **5%, *10%.*

Table A1b - From cultural heritage to development: interaction between artistic and scientific creativity

	Structural Eq. GDP growth	Artistic Creativity	Scientific Creativity	Economic Creativity
	(1)	(2)	(3)	(4)
artistic creativity	0.565			
	(5.119)			
scientific creativity	-0.156			
	(0.267)			
art*sci creativity	-30.727			
	(105.583)			
economic creativity	0.107			
	(2.504)			
cultural heritage	0.134***			
human capital	0.042*			
population density	0.000**			
GDP per capita	-0.037			
	(0.037)			
innovation	-3.786			
	(14.742)			
manufacturing	0.026			
	(0.024)			
population (size)	0.000			
	(0.000)			
london	0.001	0.002***	0.009***	-0.000
	(0.007)	(0.000)	-0.002	(0.000)
GDP per capita $_{t-6}$		0.004	-0.055***	0.005
		(0.006)	(0.018)	(0.004)
cultural heritage $_{t-6}$		0.000	0.006	0.010*
		(0.007)	(0.011)	(0.005)
diversity $_{t-6}$		-0.006***	-0.022***	0.003***
		(0.001)	(0.006)	(0.001)
human capital $_{t-6}$		0.011***	0.081***	-0.001
		(0.001)	(0.011)	(0.001)
population density $_{t-6}$		0.000***	0.000	-0.000**

		(0.000)	(0.000)	(0.000)
population (size) $_{t-6}$		0.000	0.000**	-0.000***
		(0.000)	(0.000)	(0.000)
manufacturing $_{t-6}$		0.003***	0.012**	0.000
		(0.001)	(0.006)	(0.000)
Regional FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
constant	-0.004	-0.002***	-0.006**	0.000
	(0.008)	(0.000)	-0.003	(0.000)
No. of observations	264	264	264	264

*Robust standard errors in parentheses. Statistical significance as follows: ***1%, **5%, *10%*

Table A1c - From cultural heritage to development: interaction between economic and scientific creativity

	Structural Eq. GDP growth	Artistic Creativity	Scientific Creativity	Economic Creativity
	(1)	(2)	(3)	(4)
artistic creativity	-1.394			
	(1.084)			
scientific creativity	-0.299			
	(0.218)			
economic creativity	-15.671**			
	(7.064)			
ec*sci creativity	494.023***			
	(181.202)			
cultural heritage	0.089***			
	(0.026)			
human capital	0.051**			
	(0.024)			
population density	0.000**			
	(0.000)			
GDP per capita	-0.056			
	(0.036)			
innovation	-4.372			
	(14.335)			
manufacturing	0.031			
	(0.023)			
population (size)	0.000			
	(0.000)			
london	0.004	0.002***	0.009***	-0.000
	(0.005)	(0.000)	(0.002)	(0.000)

GDP per capita $_{t-6}$		0.004	-0.055***	0.005
		(0.006)	(0.018)	(0.004)
cultural heritage $_{t-6}$		0.000	0.006	0.010*
		(0.007)	(0.011)	(0.005)
diversity $_{t-6}$		-0.006***	-0.022***	0.003***
		(0.001)	(0.006)	(0.001)
human capital $_{t-6}$		0.011***	0.081***	-0.001
		(0.001)	(0.011)	(0.001)
population density $_{t-6}$		0.000***	0.000	-0.000**
		(0.000)	(0.000)	(0.000)
population (size) $_{t-6}$		0.000	0.000**	-0.000***
		(0.000)	(0.000)	(0.000)
manufacturing $_{t-6}$		0.003***	0.012**	0.000
		(0.001)	(0.006)	(0.000)
Regional FE	YES	YES	YES	YES
Time FE	YES	YES	YES	YES
constant	-0.003	-0.002***	-0.006**	0.000
	(0.007)	(0.000)	(0.003)	(0.000)
No. of observations	264	264	264	264

*Robust standard errors in parentheses. Statistical significance as follows: ***1%, **5%, *10%.*

Table A1d - From cultural heritage to development: interaction between economic and artistic creativity

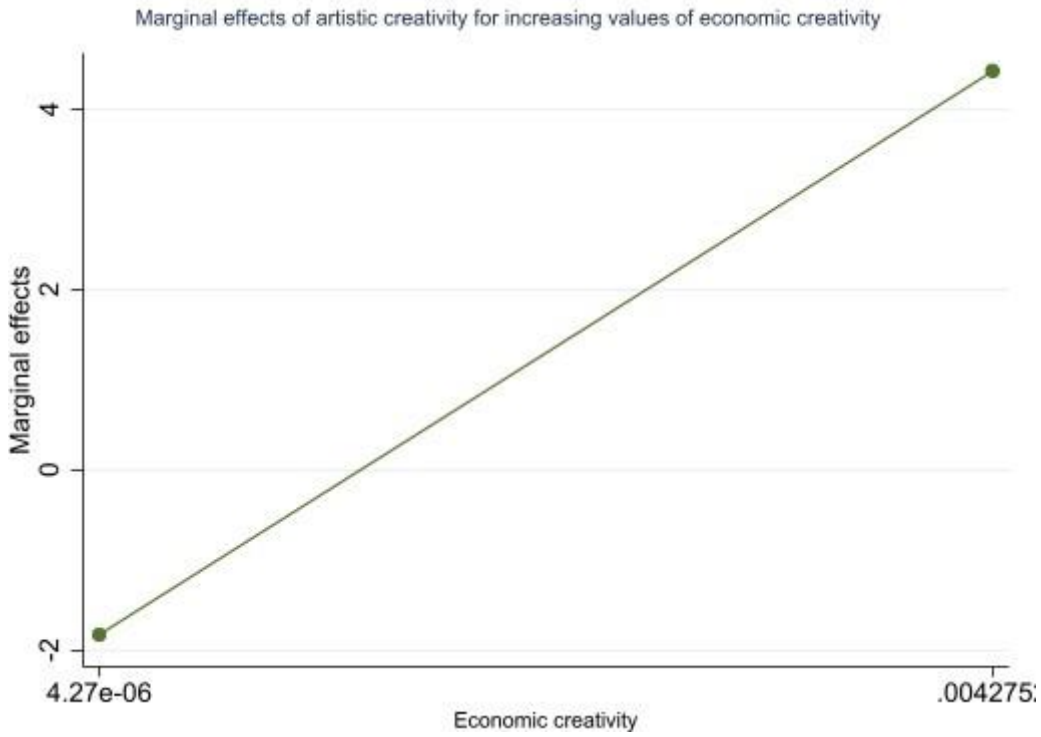
	Structural Eq. GDP growth	Artistic Creativity	Scientific Creativity	Economic Creativity
	(1)	(2)	(3)	(4)
artistic creativity	-1.838*			
	(1.089)			
scientific creativity	-0.226			
	(0.219)			
economic creativity	-8.554*			
	(4.429)			
ec*art creativity	1465.828***			
	(499.067)			
cultural heritage	0.094***			
	(0.024)			
human capital	0.054**			
	(0.024)			
population density	0.000**			
	(0.000)			
GDP per capita	-0.049			
	(0.035)			
innovation	-6.586			
	(14.324)			
manufacturing	0.032			
	(0.023)			
population (size)	0.000			
	(0.000)			
london	0.004	0.002***	0.009***	-0.000
	(0.005)	(0.000)	(0.002)	(0.000)
GDP per capita $_{t-6}$		0.004	-0.055***	0.005
		(0.006)	(0.018)	(0.004)
cultural heritage $_{t-6}$		0.000	0.006	0.010*
		(0.007)	(0.011)	(0.005)
diversity $_{t-6}$		-0.006***	-0.022***	0.003***
		(0.001)	(0.006)	(0.001)
human capital $_{t-6}$		0.011***	0.081***	-0.001
		(0.001)	(0.011)	(0.001)
population density $_{t-6}$		0.000***	0.000	-0.000**
		(0.000)	(0.000)	(0.000)
population (size) $_{t-6}$		0.000	0.000**	-0.000***
		(0.000)	(0.000)	(0.000)
manufacturing $_{t-6}$		0.003***	0.012**	0.000
		(0.001)	(0.006)	(0.000)
Regional FE	YES	YES	YES	YES

Time FE	YES	YES	YES	YES
constant	-0.004	-0.002***	-0.006**	0.000
	(0.007)	(0.000)	(0.003)	(0.000)
No. of observations	264	264	264	264

*Robust standard errors in parentheses. Statistical significance as follows: ***1%, **5%, *10%.*

Annex 3 – Marginal effects of artistic and scientific creative talents for increasing values of economic creativity

Figure 3a



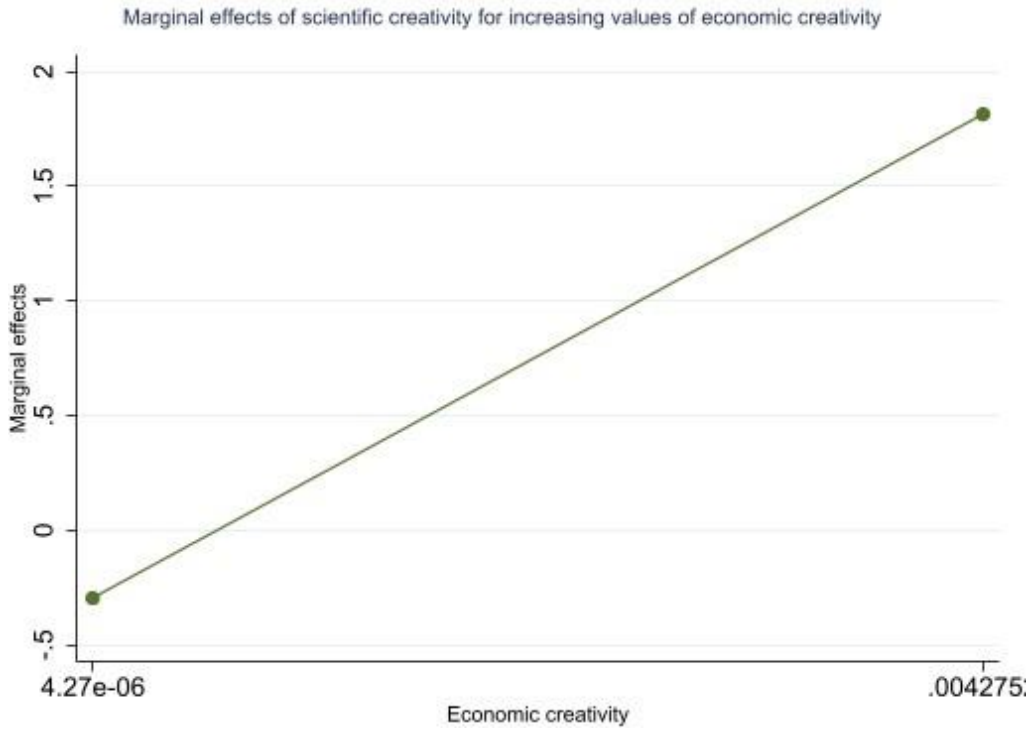


Figure 3