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Relatedness and growth: The impact of creative industries to the wider economy

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Abstract

The role of the cultural and creative industries (CCIs) in fostering both innovation and growth in the wider economy has been much debated, beginning with Bakhshi et al.'s (2008) seminal contribution. Such studies of creative environments tend to assign a strategic role to territories, but they provide little empirical evidence. In this paper, the issues of the creative economy are combined with evolutionary economic geography (EEG) topics in an attempt to understand whether the CCIs are able to foster innovation and growth in the wider economy. Using an indicator of the relatedness density between the creative and other sectors for the Italian provinces, we analyse employment growth and innovation over a period of ten years (2006–2015) by drawing from the AMADEUS database. A panel data analysis is then applied to investigate the role of relatedness and the clustering of the creative industries in wider economic growth, which shows that, at a local level, the creative industries require the presence of other sectors with a high degree of cognitive proximity/relatedness, while the capacity for development and innovation does not merely depend on their presence, but also on their relations and interdependencies with other economic sectors.

Key words: creative industries; employment growth; innovation; cognitive proximity; industry space.

Jel Code: R11, O10

1 Introduction

The cultural and creative industries (CCIs) have long been the subject of intense debate, not only among scholars of regional sciences and creative research, but also within the field of management and innovation studies (UNCTAD, 2008; Jones et al., 2015).

The seminal contribution made by the Jacobian diversification economies, that is, the innovative capacity to combine and recombine the Schumpeterian creative destruction, constitutes a leitmotif in the academic debate (Glaeser et al., 1992; Beaudry and Schiffauerova, 2009). Marshall's contribution has also entered into the conversation concerning cultural economics, especially within Italy and in relation to the innovative capacity of places, the process of cross-fertilisation and the creative atmosphere (Bertacchini and Santagata, 2012; Sacco et al., 2013). Additionally, the themes of creativity, innovation and entrepreneurship are frequently dealt with together, thereby providing new impetus for the analysis of the strategic role of the initial phases of innovative processes (idea generation), rather than just the final phases (innovation implementation and transfer) (Lee et al., 2004; Scott, 2006).

The CCIs constitute a strategic sector, playing a key role in both development and innovation (Power and Nielsen, 2011). In fact, the CCI sector is characterised by a high level of variety/diversity, as evidenced by the copious classifications worked out by different international organisations (Throsby, 2008; EC, 2010). These sorts of activities usually tend to cluster, concentrating in metropolitan cities, although they subsequently spread to more rural areas (Lorenzen and Frederiksen, 2008; Bell and Jayne, 2010).

This study aims to contribute to the present debate by focusing on a relevant academic issue that has grown out of the seminal contribution of the NESTA report by Bakhshi et al. (2008), which maintains that CCIs can strongly influence development and innovation within all sectors, that is, within the so-called wider economy. The authors discuss the CCIs' ability for innovation as being the result of both a high degree of diversity/variety and the ensuing process of inter-sectoral cross-fertilisation. In a later study, the same authors (Bakhshi and McVittie, 2009) investigate the way in which the creative industries affect innovation along the industrial supply chain.

While a great deal has previously been written on this topic from a theoretical point of view (Andari et al., 2007; Chapain et al., 2010; Marco-Serrano et al., 2014), to the best of our knowledge, the prior empirical investigations intended to measure the real weight of the creative sectors in terms of development are still scarce, if not controversial (Oakley, 2004; Muller et al., 2009).

One of the main reasons for the lack of an academic body of literature, may be the strong heterogeneity/diversity that characterises the creative sector. This feature may result in difficulties in relation to capturing the connections between the CCIs and all the other sectors and, consequently, measuring their impact on innovation and economic growth. It is an emblematic case of 'hidden innovation', since this diversity may imply the existence of a problem of identification within the official statistics (Miles and Green, 2008; Barge-Gil et al., 2011; Lee and Draver, 2013).

In terms of tackling this issue, we suggest following an evolutionary economic geography (EEG) approach that focuses on the impact of variety/diversity on the local development and geography of innovators. In particular, we follow the theory of cognitive proximity/relatedness when studying the impact of the CCIs on the wider economy because we suppose that their contributions to the wider economy are due to their capacity to foster the cross-fertilisation process and transversal innovations in local economic development (Cooke, 2012).

Starting from the assumption that the variety/diversity of creative environments is determined by the presence of creative businesses providing inputs into cross-fertilisation processes, cognitive proximity becomes the crucial factor in stimulating knowledge exchange among different sectors (Asheim et al., 2011). This phenomenon has been widely explored by means of EEG with regards to innovation dynamics and potential knowledge transfers within the industrial sectors (Frenken et al., 2007; Boschma et al., 2015), although only a few studies have investigated the impact of the creative industries (Boix et al., 2014; Casprini et al., 2014; Lazzeretti and Capone, 2016).

In the present study, we apply Hidalgo et al.'s (2007) methodology to the creative sector for the first time in order to study the impact of the creative sector on the wider economy and explore new trajectories in the geography of innovation.
Using an indicator of the relatedness density between the creative industries and all the other sectors in the Italian provinces, we use a panel data analysis to analyse the employment growth and innovation over a period of ten years (from 2006 to 2015) with data drawn from a firm-level database (AMADEUS - Bureau Van Dijk).
The results show that the creative industries, in order to foster growth in local employment, require the presence of other sectors with a high degree of relatedness. This outcome suggests that, the capacity to develop and innovate does not only depend on the creative industries *per se*, but also on the relations and interdependencies they have with other local sectors.
The remainder of this paper proceeds as follows. In sections 2 we retrace the theoretical debate regarding the role of the CCIs in the growth and innovation of the wider economy, with a focus on the relations among innovation, variety and relatedness as investigated in various EEG studies, particularly those studies employing Hidalgo et al.'s (2007) methodology. In section 3 the research hypotheses are outlined. In section 4, we present our research design, while section 5 details the main results we obtained. To conclude, in section 6, we discuss those results in light of existing interpretations and we suggest some avenues for future research.

2 Theoretical background

2.1 Creative industries, innovation and growth in the wider economy

In Europe, especially in the UK, the debate concerning the creative economy's contribution to development and innovation has flourished, not least because of its implications in terms of smart specialisation, smart cities and smart manufacturing applications, particularly following the 2008 economic crisis (Jeffcutt and Pratt, 2009; Foray, 2015).
The CCIs have become an important topic within the academic debate concerning the creative economy (Lazzeretti et al., 2017), with some authors suggesting the rise of the 'economics of creative industries' (Potts, 2016) to be an autonomous discipline, while others have also discussed the integration of creativity, innovation and entrepreneurship in the new competitive landscape (Shakkey, 2015).
During the last decade, a strand of literature has developed regarding innovations within the creative industries. Some authors try to assess the characteristics of the CCIs as a peculiarity in terms of innovation (Grantham and Kaplinsky, 2005; Stam et al., 2008), others discuss the different categories of innovation (Castañer and Campos, 2002), while others focus on the role of organisation in artistic innovation (Handke, 2007) and still others study the business model of the music industry (Dobusch and Schüßler, 2014). There are also several cases in which the economic renewal of traditional sectors has been realised by adding a cultural dimension, that is, the so-called 'traditiovations' (Cannarella and Piccioni, 2011). An emblematic case study in this regard is that of Italian haute cuisine, which recombines traditional Italian cooking with components of different cooking cultures, including even quite remote countries (Petruzzelli and Savino, 2015). Finally, another important example is that of design-driven innovations, or typical transversal innovations, ranging from building and green design to food design and others (Verganti, 2009).
What emerges from all these studies is the idea that the CCIs play an important role in fostering the innovation process, not only with regards to technological innovations, but also in terms of the ability to completely rethink the design of products or services, the organisational aspect or the business model (Von Hippel, 2007; Parkman et al., 2012; Lyubareva et al., 2014). There is a heavy emphasis on the kind of 'soft' innovation promoted by the CCIs, that is, a continuous innovation in all fields that influences every subject and fosters the emergence of social innovation as an enabler of other innovations, especially technological and organisational innovations (Pol and Ville, 2009; Tafel-Viia and Lassur, 2013). Even if the role of the CCIs as enablers of innovation is well sustained (Bakhshi et al., 2008; Power and Nielsen, 2011), in order to deal with the measurement problem (i.e.

hidden innovation) many authors focus on the CCIs' role in fostering productivity, wealth and employment growth, using the same results to draw conclusions in terms of the capacity of the CCIs to influence the rise of innovations. In this respect, Stam et al. (2008) identify the positive impact of the creative industries on urban employment growth in the Netherlands, although they warn that this impact vanishes when the city of Amsterdam is excluded from the sample. Other authors show the stronger impact of the creative class concentration than that of the CCIs themselves (Marlet and Woerkens, 2007). Further, De-Miguel Molina et al. (2012) find a positive impact on wealth of CCI concentrations at a European level.

Muller et al. (2009) use a very large survey of European creative enterprises to examine the impact of innovation. They identify some interesting differences, namely while software and advertising show the strongest links with industrial innovation, architecture and content providers contribute relatively little.

With regards to the relation between the creative industries and the rest of the economy, Potts and Cunningham (2008) identify four models: welfare, competition, growth and innovation. They find broad support for the growth model, and they further suggest that the CCIs should be seen as an important element of the innovation system of the economy as a whole.

Some authors find empirical evidence concerning the effect of both creative workers and industries on the growth of a territory or region (McGranahan and Wojan, 2007; Piergiovanni et al., 2012), arguing that the impact is due to the capacity of the CCIs to contaminate other sectors and so foster the rise of innovations. However, the prior literature focuses more on the role of the concentration and clustering of creative industries and workers than on the quantification of the real impact of the CCIs on the whole economy (Boix et al., 2014; Lee and Pose, 2014).

In conclusion, relatively few empirical works demonstrate the extent of the creative industries' impact on employment growth in a specific area. Empirically, the role of a variety of creative industries in local growth remains almost entirely unexplored, especially in terms of EEG, which might play a strategic role in understanding this phenomenon. However, in the recent debate, the concept of proximity has undergone an important diversification, since it now defines the distance between sectors, clusters, professions or businesses not just in physical or relational terms, but especially in cognitive terms (Boschma, 2005). Thus, this approach highlights the relevance of a high cognitive proximity between the actors involved in a creative and innovative process. This does not necessarily refer to only the interaction between creative actors. Indeed, to ensure the success of the creative process and produce innovations that are potentially beneficial for the area, what really matters is the capacity for interaction and the opportunity to exchange knowledge.

2.2 Innovation, variety and relatedness

In recent years, the regional science literature has frequently focused on diversity rather than specialisation as the factor that explains the specific performance of regions (Boschma and Frenken 2009). In this regard, the concept of relatedness is particularly useful because it captures both dimensions and identifies the proximity of sectors that are usually not considered to be as close as they really are.

In the field of innovation studies, the role of variety is garnering increasing attention at a firm (Garcia-Vega, 2006; Ostergaard et al., 2010), network (Phelps, 2010; Corsaro et al., 2012) and regional level (Desrocher, 2001; Boschma and Frenken, 2009).

Variety is also considered important in research and development (R&D) collaborations, both in terms of the quality of partners and of complementary knowledge and technology as a factor in innovation performance (Cohen and Levinthal, 1990; van Beers and Zand, 2014; Rodriguez et al., 2017).

Many prior studies explain how technological variety is necessary for the development of new ideas and products, although, being frequently defined as a matter of the right distance, it is generally emphasised as a need for – not too much – diversity (Quintana-Garcia et al., 2008). If local companies are engaged in not particularly diverse activities or they are too similar to each other, the spillovers tend to produce mostly incremental innovations and improve the portfolio products or production processes. Yet, if the fields in which local companies are working are too diverse, there will be little opportunity for connection, while collaboration will prove very complex due to the different 'language' used by the firms involved (Noteboom et al., 2007; Balland et al., 2015).

In particular, the studies conducted during the last two decades emphasise the evolution of collective learning and knowledge spillovers (Capello and Faggian, 2005). In both fields of study, the works concerning the role of technological diversity and cognitive proximity typically use the NACE categories to define the proximity in the particular field in which an area or a firm are involved. In terms of the regional sciences, this kind of analysis frequently stresses the role of agglomeration economies in both innovation and growth, a topic that is particularly meaningful in the Italian context (Glaeser, 1992; Cainelli and Leoncini, 1999; Forni and Paba, 2002; Lasagni, 2011; Mameli et al., 2014).

The majority of these works present a similar problem in that they usually refer to a standard industrial classification, so that the concentration in a particular field (or the proximity among different technological categories) is computed using *ex-ante* categories. Over the last few years, a new way of looking at the relatedness or proximity among sectors has developed. Following the methodologies proposed by Hidalgo et al. (2007), it is now possible to measure the relatedness among different products or industrial categories. In his original work, the relatedness measure is based on the idea that two products are related if they are co-exported at a higher level than the national average by several nations. The same could be easily applied to the industrial categories, which are considered to be related when they are jointly present in many Italian provinces with an employment level higher than the national average.

In recent years, many studies have followed the present approach. One line of research uses this methodology to understand technological evolution, as well as the rise and fall of technologies, using patent data (Rigby, 2012; Kogler et al., 2013; Boschma et al., 2015; Petralia et al., 2017). Other studies, such as that conducted by Neffke et al. (2011), seek to answer the same question by using plant data obtained from the manufacturing industries. Further, Boschma et al. (2012) use this method to measure the relatedness that exists between different industrial categories, and they then apply the related variety concept to demonstrate how different ways of capturing such relatedness can identify better or worse relations between diversification, innovation and growth. Another interesting study uses labour flows to measure the relatedness among different sectors, thereby capturing firms' diversification strategies (Neffke et al., 2012), while Boschma et al. (2013) apply this methodology to identify the emergent dynamics of the new Spanish industries, employing export data in a similar fashion to the original work of Hidalgo et al. (2007).

Starting from the 1980s, several works have been devoted to innovation studies and the analysis of knowledge spillovers among different technological classes. Many attempts have been made to measure the relations between the technological categories (Jaffe, 1986; Teece et al., 1994; Petruzzelli, 2011) through a survey of applications mainly related to patents and the number of quotations received, while other studies have also outlined the main measurement problems encountered.

Currently, in the field of CCI studies, only relatively few contributions have investigated the role of variety and diversity in incentivising innovations and growth, although the importance of variety and the need for a fair degree of proximity are generally acknowledged, at least theoretically (Hauge and Hracs, 2010; Desrocher and Leppala, 2011; Garcia-Martinez, 2015). Therefore, it would be beneficial to ascertain whether the creative sectors do contaminate other sectors that are distant in terms of their industrial classifications, while also being able to foster more innovation outside than within. In other words, '[CCIs are] not just an island of talent and economic power, but an intrinsic part of the entire system' (Bakhshi et al., 2008, p. 3).

The variety concept, which was originally seen as a determining factor for both urban and regional economic development as well as innovation (Frenken et al., 2007), becomes crucial when applied to the creative industries (Berg and Hassink, 2014). This line of research points to the need for a local system with a certain degree of cognitive proximity, which thus promotes innovation and economic development in the area (Boschma, 2005).

3 Hypothesis development

The role of the CCIs in developing innovation and growth is a topic that has been widely debated in the recent literature (Piergiovanni et al., 2012; Antonietti, 2015). Many authors argue that the creative industries are capable of generating significant buzz and promoting interactions with other enterprises in such a way as to foster the innovative process (Knudsen et al., 2008), employment growth (Stam et al., 2008) and entrepreneurship (Boschma and Fritsch, 2009) as well as increasing the well-being of the area (De-Miguel Molina et al., 2012).

The effect that creative capital, which is comprised of CCI workers, has on the innovative performance of the area, as well as how it reflects on both productivity and employment, can be considered as a form of externality generated human capital on the part of the CCIs. The presence of creative workers will affect the innovative performance of firms and the generation of social innovations, which will in turn foster employment growth in the area.

Hypothesis 1: *Creative industries are able to foster innovation and employment growth in the wider economy.*

The reasons for the clustering of the CCIs are still strongly debated in the literature (Lazzeretti et al., 2008; Boix et al., 2015); however, it is particularly interesting that the effects of the concentration of creative workers are considered to be a driving force behind the competitiveness of firms and the growth of the area (Piergiovanni et al., 2012). The concentration of creative workers allows for a continuous interaction between them as well as an exchange of ideas and opinions that foster the diffusion of knowledge and innovative performance in the area (Chapain et al., 2010). Indeed, people talk, discuss, work, interact and promote new ideas, and this occurs more frequently in the case of a high concentration of creative workers in the same area (Currid, 2007). The above arguments therefore lead to the following hypothesis:

Hypothesis 1a: *The clustering of the CCIs fosters innovation and employment growth in the wider economy.*

Another aspect that has received a significant amount of attention in the literature is the ability of the CCIs to interact with other sectors and so encourage the development of new ideas and the generation of innovations (Boschma and Fritsch, 2009; Lazzeretti et al., 2017). The CCIs are able to generate unusual innovative processes by fostering the exchange of ideas between apparently distant sectors and providing added value that will facilitate the innovative process, cross-fertilisation and the development of unconventional technical relations. Following the reasoning of Lester and Piore (2004), innovations often develop from something very different to an analysis, something like an open discussion. Additionally, the heterogeneity of the participants seems important in relation to generating innovative ideas. In fact, following their reasoning, opportunities for innovation and profit are created in ambiguous spaces.

These interactions are often influenced by the presence of CCIs that are characterised by a high inclination to interact and exchange ideas. Therefore, it is not merely the concentration of the CCIs that fosters innovation and growth, but rather the presence in the area of creative industries and other cognitively related firms (Markusen et al., 2011).

We will explore this line of research by investigating the role played by the creative industries in fostering growth and innovation in the wider economy. The hypothesis we test in this regard, based on what has previously been argued, is as follows:

Hypothesis 1b: *The clustering of the CCIs with cognitively closed 'non-creative' industries fosters innovation and employment growth in the wider economy.*

We use two different measures to test our hypotheses, namely a measure of formal innovation (patent and design) and employment growth as a proxy to measure the impact of the CCIs on the wider economy. This latter measure will also capture the innovative capacity, since the other measures of formal innovation outlined so far do not account for the non-formalised ‘hidden innovation’ that is particularly relevant for innovation processes when the CCIs are involved (Miles and Green, 2008; Lee and Draver, 2013), which has been discussed in the above literature. In order to concentrate our study on cross-fertilisation processes and transversal innovations, we focus on ‘outside’ (rather than inside) the creative sector so as to take into account the relation between the creative industries and the economy as a whole.

4 Research design

4.1 Data source and definition

This study concerns the totality of the Italian provinces[1] corresponding to the NUTS-3 classification of the European Union. The data, for the sake of consistency over the chosen timeframe, relate to the provinces that existed prior to the 2006 and 2009 revisions, that is, a total of 103 provinces.

The main data, which are drawn from the firm-level AMADEUS database of Bureau Van Dijk, refer to the number of employees subdivided by the NACE code, up to the four-digit level of detail. The database includes only those firms that provide balance sheets. Consequently, the sectors characterised by a composition of small- and micro-sized firms are underreported in the database.[2]

The data used for calculating employment growth are drawn from the ISTAT (Italian National Institute of Statistics) database and refer to the number of employees at a provincial level for each year from 2006 to 2015.

The other data necessary to construct the remaining variables are drawn from different sources (EUROSTAT and the European Patent Office), which were provided or collected again for the same unit of analysis at the NUTS-3 level (103 provinces).

The period under study runs from 2006 to 2015, a relatively long period characterised by numerous changes at all levels, particularly the 2008 economic crisis.

Table 1 - Creative industries according to the DCMS, 2013

Advertising	*Motion picture, video and TV*
73.11 Advertising agencies 73.12 Media representation	59.11 Motion picture and video production activities 59.12 Motion picture, video and TV post production activities 59.13 Motion picture and video distribution activities 59.14 Motion picture projection activities
Architecture and engineering	*Photography*
71.11 Architectural activities	74.20 Photographic activities
Arts and entertainment	*Programming and broadcasting activities, TV and radio*
90.01 Performing arts 90.02 Support activities to performing arts 90.03 Artistic creation 90.04 Operation of arts facilities	60.10 Radio broadcasting 60.20 TV programming and broadcasting activities
Computer programming	*Publishing*
62.01 Software production 62.02 Computer consultancy activities	58.11 Book publishing 58.13 Publishing of newspapers 58.14 Publishing of journals and periodicals 58.19 Other publishing activities
Design activities	*Sound recording and music*
74.10 Specialized design activities	59.20 Sound recording and music publishing activities

Source: Authors’ elaboration from DCMS (2013).

[1] We use the province as the unit of analysis rather than the local system, since these are the only available data for conducting a ten-year longitudinal analysis.

[2] However, in order to capture the representation level of our database, a comparison with census data was performed for the year 2011, which exhibited a good level of representativeness, save for some minor changes, mainly in the micro-firm sectors.

As for the creative industries, which were first catalogued by the UK Department of Culture, Media and Sport (DCMS) in 1998, this study takes into account the classification contained within the *Creative Industries Mapping Document* (DCMS, 2013). This classification is based on the creative intensity of economic activities and it defines the following groups: advertising, architecture, arts and entertainment activities, computer programming activities, design, motion and video, photography, programming and broadcasting activities (television and radio), publishing, sound recording and music. Table 1 summarises the creative industries selected for the analysis and then converted into NACE Rev. 2 economic activities at the four-digit level.

4.2 Methodology

In the recent literature, many methods have been used to measure the relatedness among industrial categories, with the most commonly used methods being the cluster-based approach (Porter 1998), related variety (Frenken et al., 2007) and indicators of proximity among different industrial sectors or products (Hidalgo et al., 2007). The present work follows the latter approach, since the methodology it uses allows for the creation of an *ad hoc* matrix of the 'distance' between the different categories, while the other methods rely on *ex-ante* definitions. This methodology has recently been applied in several studies concerning development and technological diversification, for example, Hidalgo et al. (2007), Neffke et al. (2011), Rigby (2012) and Boschma et al. (2013; 2015). However, to the best of our knowledge, no studies have been conducted that take into account the creative industries.

Following the methodology of Hidalgo et al. (2007) regarding the creation of the *product space*, we intend to recreate an *industry space* (Neffke et al., 2011) among the industrial categories in order to determine their proximity. However, the industry space will be constructed in a different way to the original, since there are no available data concerning labour flows among different industries. The number of workers employed in each industrial category will be used to determine whether there is a higher or lower proximity among them. Our method further differs from that of the 'product space construction', where export data are used to compute the proximity among products, since this would have caused the loss of many categories in the service sectors as well as in the creative industries because they do not export any goods (e.g. architectural activities, design or performing arts).

The product space, in general, represents the network of exported products, wherein the nodes denote each product and the lines denote the degree of relatedness between them, which is based on the idea that two products are related if they are co-exported by many nations. In our case, we use the same concept of industrial categories and consider those categories that are present together in many Italian provinces with an employment level higher than the national average to be related, which represents our *industry space*.

We create an $n*n$ matrix wherein n is the number of industrial categories considered – 560 in our case – as classified according to the NACE classification, and we calculate the degree of relatedness as follows:[3]

$$\varphi_{i,j,t} = \min\{P(RCAx_{i,t} \mid RCAx_{j,t}), P(RCAx_{j,t} \mid RCAx_{i,t})\}$$

The relatedness of every pair of industrial categories is calculated as the minimum of the conditional probability for every Italian province to identify industrial category i, given that category j is already available in the given province.

Following this first step, we compute the relatedness among all the pairs of 560 NACE categories at the four-digit level. The result is a total of 156,800 proximity indices, which will be used to compute an indicator of the concentration of proximity between the creative sectors and all the other sectors for each Italian province and over each of the nine years analysed (2006–2014):

[3] This is the formula for the product space (Hidalgo et al., 2007, p. 3).

$$D_{jt} = \sum_{s=1}^{S} R_{ck} \left(\frac{n_{cj}+n_{kj}}{N_j}\right) \qquad (1)$$

where j indicates the province, R_{ck} is the proximity among the creative sector c and the 'non-creative' sector k, n_{cj} is the number of employees in sector c for j province, n_{kj} is the number of employees in sector k for the same province, and N is the total number of employees of the province. This indicator allows us to establish a provincial value of proximity between the creative industries and all the other sectors, from which we infer the concentration of creative workers close to other workers in related fields, with whom they exchange knowledge or ideas, or encourage cross-fertilisation processes and other interactions liable to promote the processes of innovation and economic growth.

A variable controlling for the clustering of the creative industries, *LQ Creat*, is added to the models. This helps us to understand whether the concentration of creative workers *per se* is a key factor influencing the growth of the area, as suggested by previous works in this field (Marlet and Woerkens, 2007; Stam et al., 2008).

Other control variables are also included in the models. The first such variable is the *population density*, which is used to control for the urbanisation level, and it is measured as the population and area ratio of the provinces.

A variable controlling for *competition* in the area, which is usually inserted into growth models, is measured here as the proportion of plants with less than ten workers present in a province divided by the same measure at the country level. This variable should define competition, although it might also determine the typical size of the industries in the area (Bishop and Gripaios, 2010), which means that the results need to be carefully evaluated.

A *patent* variable related to innovation in each province is also added, which is computed as the number of patents per million of inhabitants. This variable is useful for assessing the innovation capability of a given territory.

In addition, a variable controlling for the *occupational level* of the area is added, namely the stock of occupation expressed as the employment rate of each province at time *t*.

In order to avoid any possible misspecifications of the model, growth regressions usually include variables concerning the national and international accessibility standards, human capital and average wages in the area. In our case, data regarding these important factors are not available; however, the study is in line with most prior studies on the role of variety in innovation and employment growth.

Another possible source of bias might arise from the potential endogeneity, since the measures of relatedness could be influenced by growth. Unfortunately, our data do not allow for the use of methods to deal with endogeneity problems, for example, external instruments correlated with X and uncorrelated with Y. As in analogous works, we thus insert a region-specific fixed effect, and we also test the panel using the lagged version of the models in order to deal with any possible endogeneity problems (Hartog et al., 2012). As the results do not substantially change and our sample is not composed of a long time series, we use the simultaneous version of the models.

The present study applies a panel analysis that can identify the relationship between innovation, employment growth and the variables of interest. This method is one of the most commonly used methods in the recent literature concerning variety, innovation and growth (Quatraro, 2010; Hartog et al., 2012; Cortinovis et al., 2015), since it is also capable of providing some indications of trends in this respect.

4.3 Variables and descriptive statistics

Table 2 presents the descriptive statistics for all the variables included in the models. The variables concerning the employment variations are drawn from the ISTAT database, and they are computed as the Δ between the employment for each year and the following year. As can be seen from the table, there is a huge variation due to two main factors. The first such factor is the fact that the period under analysis is characterised by two very different sub-periods, one of growth and one – starting from 2008 – of economic crisis and recession. The second factor is associated with the specificities of Italy, which is known to be affected by a huge disparity, mainly in terms of industrialisation, between the north and the south of the country. This implies the different impacts of both growth and recessionary periods, mainly with regards to employment in the industrial sectors. In fact, as can be seen from the table, there is a huge difference between the maximum and minimum growth of this variable.

Table 2 - Descriptive statistics

	No. of cases	*Min*	*Max*	*Mean*
Emp. Grow.	927	-0.159	0.102	-0.003
Emp. Grow Ind.	721	-0.642	0.592	-0.001
Emp. Grow Serv.	721	-0.196	0.186	-0.015
Relatedness	927	1.501	3.171	2.301
Emp. R.	927	35.17	72.70	57.75
Density	927	19.23	2691	256.87
LQ Creat.	927	0.028	4.564	0.732
Competition	618	0.978	1.024	1.003
Patent	721	0	647	66.47

Source: Authors' elaboration.

Table 3 presents the correlation matrix among the main variables included in the models. There are no worrisome values, since the highest level of correlation (-0.684) is found among the *patent* and *competition* variables. Despite this, further multicollinearity tests were performed using the variance inflation factors (VIF), which did not reveal any particular problems.

Table 3 - Correlation matrix

	Emp. Grow.	*Relatedness*	*Emp R.*	*Density*	*LQ Creat*	*Competition*	*Patent*
Emp. Grow.	1						
Relatedness	0.0931	1					
Emp. R.	0.1158	-0.1669	1				
Density	0.0762	0.2381	0.0822	1			
LQ Creat.	0.0369	0.5671	0.1879	0.3346	1		
Competition	-0.1554	0.1417	-0.6502	-0.3413	-0.1024	1	
Patent	0.1265	-0.0720	0.6395	0.2546	0.1387	-0.6844	1

Source: Authors' elaboration.

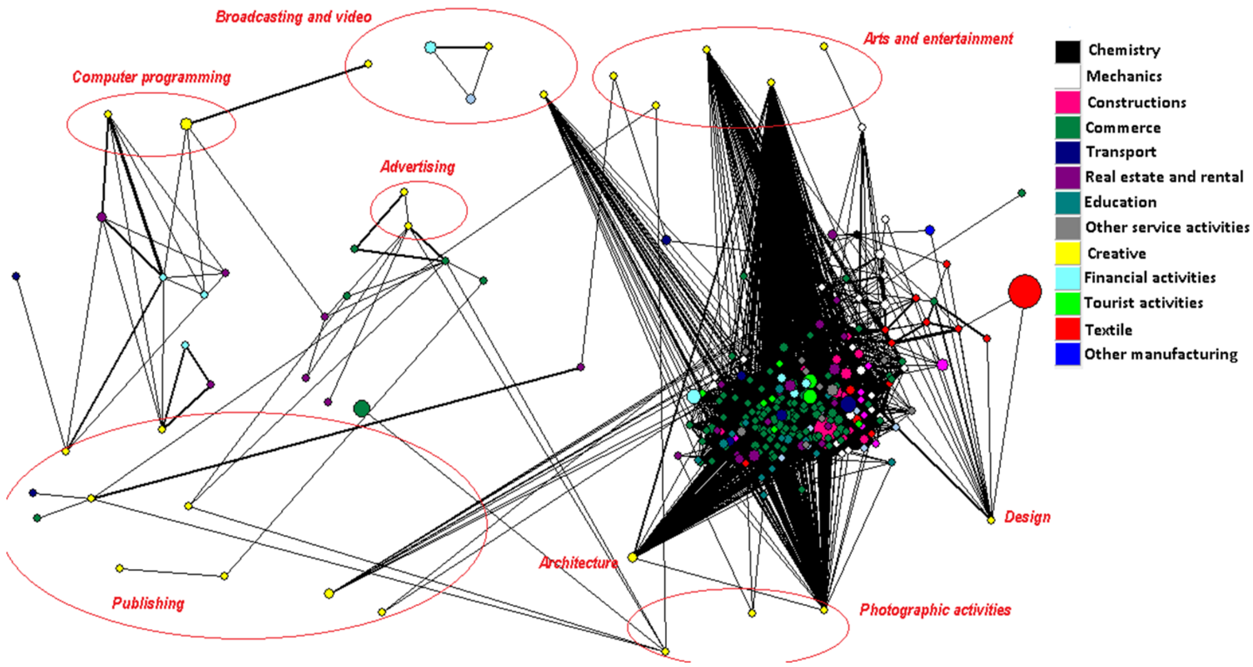
5 Estimation results

5.1 The industry space

Resulting from the use of the abovementioned methodology for the calculation of the proximity index among the industrial categories, figure 1, presents the ego network of the creative industries, allows us to understand which creative industries are the most connected as well as which of their categories are better connected to the other industrial categories. For example, we can see that design activities are well connected to both textile industries and manufacturing activities.

The node's dimension indicates the number of employees, while the thickness of the line indicates the level of relatedness between the two categories, and its colour indicates the industrial area they belong to. It is possible to note how some sectors are fully interconnected as well as how the relations are not as significant between categories belonging to the same macro-sectors (same colour of nodes). This serves to highlight the importance of using a methodology that measures cognitive proximity rather than an ex-ante classification.

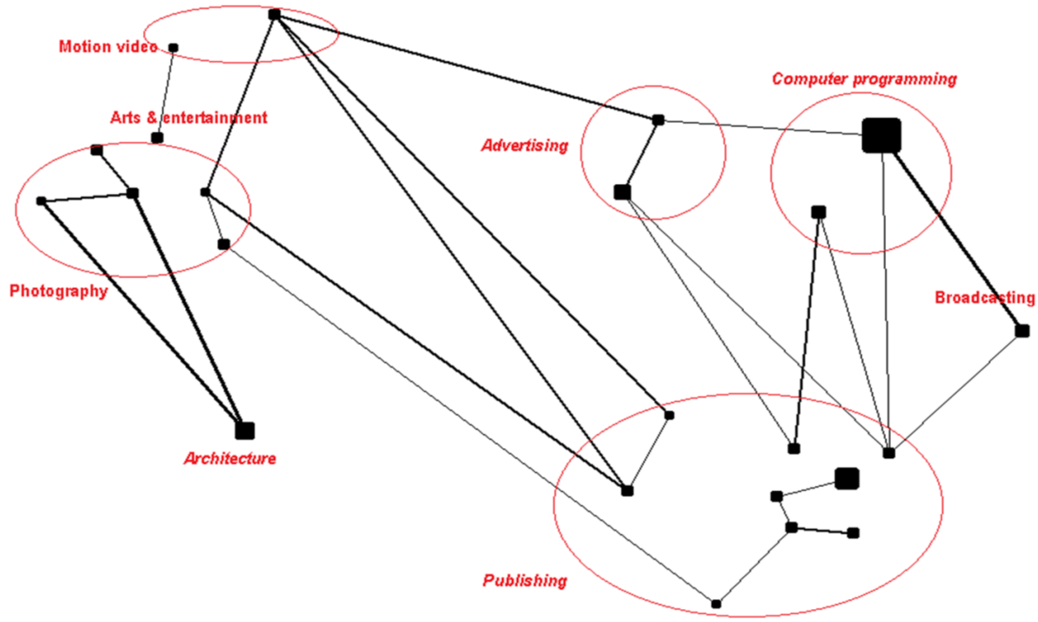
Figure 1 - Ego network of creative industries' relatedness



Source: Authors' elaboration from ISTAT data (2011).

Figure 2 represents the network of the creative industries alone, which is not the focus of the present work, although it helps to explain the degree of proximity among the creative industries as well as the difference in proximity internal and external to the CCIs. For instance, it is possible to note how the motion video category is connected to publishing, advertising and photography; how computer programming is connected to broadcasting, advertising and publishing; how architecture is only connected to photography; and so on.

Figure 2 - Relatedness between creative industries



Source: Authors' elaboration from ISTAT data (2011).

The figures discussed above are only a representation of the proximity of the industrial categories. The aim of this study is to determine whether a high level of proximity between the creative industries and other industrial categories in a specific place can be a driver for innovation and employment growth in the wider economy. In order to understand this relation, an indicator of the proximity concentration for each Italian province is needed. This measure of the relatedness concentration, which is constructed using equation (1) presented in the methodological section, is calculated for every Italian province for all the years of interest, and it is then entered into a regression analysis.

5.2 Model estimations and results

In this study, based on the most recent line of research, a panel data analysis is performed (Quatraro, 2010; Cortinovis and van Oort, 2015). The structure of the models is as follows:

$$\Delta y_{i\,t} = \alpha_i + \lambda_i + \beta_1 Y_{it} + \beta_2 Relatedn_{i\,t} + \beta_3 Density_{i\,t} + \beta_4 LQ\ Creat_{i\,t} + \beta_5 Compet_{i\,t} + \beta_6 Patent_{i\,t} + \epsilon_{i\,t}$$

where $\Delta y_{i\,t}$ is the employment growth rate between t and t_1, α_i represents the province dummies, λ_i represents the time dummies included in the model and Y_{it} is the stock of occupation in the area. Additionally, every model includes the variable of interest, namely *Relatedness*, the *Density* variable and the *Lq* variable for the creative industries. Only model 2 includes the *Competition* and *Patent* variables. This is due to issues of data availability concerning those two variables, which made it necessary to reduce the period of analysis from nine to five years.

Table 4 - Estimation results

	Model 1		**Model 2**		**Model 3**		**Model 4**	
Variables	*Emp. Grow 2006-15*		*Emp. Grow 2008-13*		*Emp. Gr.Ind.2008-15*		*Emp. Gr.Serv.2008-15*	
	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err
Relatedness	**0.0557*****	0.0078	**0.0758*****	0.0120	**0.0787**°	0.0490	**0.0865*****	0.0183
Density	-0.0310	0.0768	0.2496	0.2022	-0.0901	0.5719	-0.0801	0.2141
LQ Creat.	**-0.0114****	0.0051	**-0.0224****	0.0079	**-0.0665****	0.0331	**-0.0236***	0.0124
Emp. R.	**-0.0101*****	0.0006	**-0.0122*****	0.0010	**-0.0164*****	0.0036	**-0.0119*****	0.0014
Competition			**-2.3210****	1.0845				
Patent			0.0001	0.0001				
Constant	0.6458	0.3931	1.5854	1.5226	1.2716	2.9421	0.9360	1.1006
R-Squared	0.395		0.432		0.066		0.187	
N. of Cases	927		515		721		721	
Province FE	Yes		Yes		Yes		Yes	
Time FE	Yes		Yes		Yes		Yes	

Significant at: °p<0.1, * p<0.05, ** p<0.01, *** p<0.001.
Source: Authors' elaboration.

Table 4 presents the results of the estimation. Model 1 tests the relation between employment growth and the relatedness of the creative industries over the period 2006–2015. The results show the positive and significant impact of relatedness on the wider economy's growth to the highest level of significance. The *Density* variable shows a non-significant effect, while the *Lq* of the creative industries has a significant and negative impact on employment growth as well as the presence of a high employment rate in the area.

These results highlight how it is neither simply the concentration of people nor that of the creative industries that fosters employment growth, but rather the co-presence and concentration of creative workers in a territory with a significant presence of other workers in cognitively related sectors.

The results contrast with those of previous studies in terms of the role of the clustering of the CCIs in employment growth (Marlet and Woerkens, 2007; Stam et al., 2008; De-Miguel Molina et al., 2012). However, they confirm the important role played by the relations between the CCIs and other

sectors, which echoes the idea of Bakhshi et al. (2008) that the CCIs need to interact with other sectors in order to generate innovation and thus promote growth. Further, the hypothesis offered by Potts and Cunningham (2008) with regards to the 'growth model' is confirmed. In fact, the relation between the creative industries and the wider economy finds broad support in the Italian case.
Model 2 tests the same hypothesis as model 1, but also includes another two variables that could have an impact on local job creation. Unfortunately, due to data constraints, this necessitates a shorter time series, taking into account only the period from 2008–2013. In this case, the *Relatedness* variable retains the same sign (i.e. positive) and is still significant. These results, although in this case CCI-specific, are in line with those of other studies concerning the role of cognitive proximity among different sectors in the development and growth of territories (Boschma et al., 2012). The *Density* variable that was analysed in the previous model is still not significant, while the *LQ Creat* variable retains the same negative sign and significance, as does the employment level of the area. The newly added *Patent* variable is not significant, while the *Competition* variable is significant and has a negative sign. This implies that strong local competition had a negative impact on job creation during the period 2008–2013. These results confirm the findings of the previous model with regards to the requirement for a high concentration of creative workers and workers in cognitively related sectors.
In models 3 and 4, the dependent variable is the employment growth in, respectively, the industrial sectors and the service sectors alone, while the variable of interest is the same as in the two previous estimations and the period analysed is from 2008–2015. The impact of relatedness on employment growth is significant and positive in both cases, albeit with a higher level of significance in the case of the service sectors. With regards to the control variables, the results of the two models are similar, since neither show any significance concerning the population density, although both reveal significant and negative relations between the employment rate and the *Lq* of the creative industries. However, in the case of the service sectors, the coefficient is more than double that seen in the other case, which shows the stronger negative impact of the concentration of the creative industries *per se* on employment growth and underlines once again the need for the creative sectors to promote job creation in the area.
In addition to testing with a stronger causal relation the impact of relatedness on the innovation performance of the area, we also used the number of patents and design registrations as dependent variables both alone and jointly with a time lag of one year. However, it is important to note that these measures are concerned with formal innovations and hence do not take into account all those innovations that are 'hidden' and that are particularly relevant in the case of the CCIs (Miles and Green, 2008).

Table 5 - Estimation results

	Model 5		**Model 6**		**Model 7**	
Variables	*Innovation 2006-13*		*Patent 2006-13*		*Design 2006-13*	
	Coeff	Std Err	Coeff	Std Err	Coeff	Std Err
Relatedness	**23.4137°**	13.6622	**1.9521°**	1.0394	**8.3642***	3.5869
LQ Creat.	**-16.0822°**	8.8173	-2.1918	5.3176	**-5.9792***	2.3492
Emp. R.	**3.1694****	1.1492	**1.1726°**	0.6931	0.2451	0.2815
Constant	-46.1361	74.9259	1.7485	45.1865	-3.7807	18.1117
R-Squared	0.141		0.086		0.112	
N. of Cases	721		721		721	
Province FE	Yes		Yes		Yes	
Time FE	Yes		Yes		Yes	

Significant at: °p<0.1, * p<0.05, ** p<0.01, *** p<0.001.
Source: Authors' elaboration.

Table 5 reports the results when using three different values to account for innovation in the provinces as dependent variables. Model 5 tests the relations among the number of patents and design registrations per million of inhabitants with the aim of better capturing the relation between our variables of interest and innovation in the province. The results demonstrate how there is a positive relation between our measure of relatedness between the CCIs and other sectors and the innovation capacity of the area, while the relation among the clustering of the CCIs is significant and negative. In models 6 and 7, the two components of the dependent variable used in model 1 are tested separately. In model 6, the results confirm a relation between the measure of relatedness and the patenting in the area, while the same results are found to a higher level of significance in model 7, which confirms that a higher level of relatedness is associated with a higher level of design in the area. However, the variable accounting for the concentration of the CCIs is not significant in model 6, meaning that in this case there is no relation between the *Lq* of the CCIs and a lower innovative capacity in the following year, while in model 7 is negative and significant as found in model 5.
These results are in line with the results of the first four models, showing the positive impact of the concentration of the CCIs with other related 'non-creative' sectors also for innovation in the area (patenting and design registration).

6. Discussion and conclusions

The main results of this study allow us to argue that the creative sector plays the role of a flywheel in relation to economic development in the area when there is a concentration of creative workers and workers in sectors characterised by a high degree of cognitive proximity with the existing CCIs.
This indicates that the creative industries should perhaps not be analysed in isolation, since on their own they are not able to promote local growth and development. The CCIs require the presence of other related sectors that allow the generation of synergies and the exchange of knowledge and ideas.
During the period under study, the mere clustering of the analysed CCIs has not had a positive impact on innovation and employment growth, while the high presence of creative workers in the area was not a development driver.
The largest part of the literature related to the clustering of the CCIs is devoted to the reason for that clustering as well as to the determinants of the CCIs' growth as a sector (Boix et al., 2014; Lee and Pose, 2014). These issues were outside the scope of the present work, since our aim was to capture the impact on the wider economy in terms of innovation and employment growth. The results of this study partially contrast with those of previous works that also find the positive effect of the clustering of the CCIs outside the creative sectors, for example, Knudsen et al. (2008) find the clustering to foster the innovative process, while Stam et al. (2008) find the positive impact of the CCIs on employment growth. Our results could be driven by the period under study, which was characterised by a strong economic crisis. In any case, the clustering of the CCIs has acted as a brake on the innovation and employment growth of the area. Another possible bias exists in the form of the unit of analysis, namely all the Italian provinces. It is possible that the clustering of the CCIs acts as the driving force behind economic development in metropolitan and densely populated areas, while in other areas the concentration of the creative industries does not reach the critical mass necessary to influence the growth of employment.
However, in isolated contexts, the creative industries are not able to promote innovation and thus foster employment growth. As shown by the analysis, the major interactions are not internal to the creative industries, but rather take place between the creative sectors and other apparently distant sectors, which evidently have a high degree of cognitive proximity to the CCIs. The creative sector in Italy accounts for approximately 5% of the total number of workers, and this percentage does not reach the critical mass necessary to generate an innovation performance high enough to lead to employment growth in the wider economy. This might be due to the argument raised by Higgs and Cunningham (2008) in the Trident methodology, who revealed how there are more creative workers employed outside the creative industries than inside those industries.

It is possible to argue that the CCIs alone are not able to promote innovation and employment growth in the wider economy. Yet, in a context where the CCIs are surrounded by other firms in related sectors, higher values are seen for innovation and employment growth in the area. The connection between creative workers and other workers employed in sectors with a high degree of relatedness allows for the generation of innovative ideas in the area, which in turn stimulates development and economic growth through cross-fertilisation processes. The mere clustering of creative workers in a context in which the rest of the workers are poorly connected to them is not sufficient to promote cross-connections and thus increase the innovation performance of the area.

The present study adds important empirical evidence to the strand of literature that upholds the important role of the CCIs in the innovation and growth of the wider economy (Bakhshi et al., 2008; Chapain et al., 2010; Marco-Serrano et al., 2014). In addition, the results are in line with those of prior studies supporting the idea that cognitive proximity is a key factor in relation to innovation and regional growth (Quatraro, 2010; Petruzzelli, 2011; Boschma et al., 2013).

Creativity seems to play a key role in local growth and innovation processes, since it fosters both diversity and variety. The presence of interactions with other cognitively related sectors is crucial to ensuring the development of new ideas as well as the facilitation of the innovation process that will lead to growth. However, as underlined by Boschma et al. (2012), 'not too much' cognitive proximity is desired in order to have something to learn from each other. Further, based on our results, we can state that it is also important for the CCIs to have a fair degree of cognitive proximity, and we can add that they need to be analysed 'not alone'.

Our findings provide useful insights for both policy makers and managers. In terms of policy implications, this study suggests that it is necessary for policy makers to take into account the need to promote the development of synergic skills and not to build 'cathedrals in the desert' that do not allow for the necessary interactions between sectors that have a strong need to interact with each other. According to the results of this study, policies aimed at the development of the CCIs need to be thought of from a wider perspective. It is therefore necessary for policy makers to adopt policies that favour the development of the CCIs, but in conjunction with those areas that have a cognitive proximity that allows them to interact and encourage the innovative process. In fact, the mere presence of the CCIs does not seem sufficient to foster the innovative process and the resultant growth of the area.

In terms of the managerial implications, our results suggest that managers should keep in mind the possible synergies and the need for collaboration between the CCIs and firms in sectors that are cognitively close (despite apparently belonging to different sectors) so as to foster cross-fertilisation and the unusual connections that appear to be important drivers of innovation and growth. It is therefore important that CCI managers do not seek to solely collaborate with other CCIs, while the managers of 'non-creative' firms should consider the CCIs as potential partners that can generate strong synergies and foster the innovation process.

6.1 Limitations and future research

We acknowledge some limitations of this study that may represent opportunities for future research. First of all, the study lacks the use of variables that can more directly measure the relationship between innovation and relatedness with regards to the CCIs and firms operating in other cognitively close sectors. In fact, even if employment growth can be seen as a result of the innovation capacity of the area, and the use of the patent and design measures as an innovation output is also in that direction, the present study does not account for all those innovations that are 'hidden', since they are not reported in standard statistical reports, although they are particularly relevant in relation to the CCIs (Miles and Green, 2008).

Second, the *meso* level (province) view of this paper is an interesting perspective because it allows for the greater generalisation of the model. However, it can also be seen as a weakness because it does not allow for the measurement of the relationships between individual companies or the identification of which firms benefit the most from the co-presence/collaboration of the CCIs.

It is important to note that these results need to be further investigated, especially with regards to the role of the creative industries in productivity. Indeed, it is possible that the presence of creative workers has a strong impact on the value added to products due to the promotion of innovative processes and the enhancement of the products made by those creative workers.
In terms of new research perspectives, we consider that the impact of the creative sector on the wider economy remains an open question, since unexplored perspectives are still emerging. Consider, for example, the new challenges that are likely ahead in the study of the variety of creativity due to the new perspective of cultural ecologies. Thinking ecologically has recently become very 'cool' and it suggests investigating the assemblage of agents that constitute cultural ecosystems. The ecological metaphor appears useful in understanding the common environment wherein a web of intricate relationships between formal and informal actors (producers, consumers, participants, organisers, connectors) arises and evolves thanks to both geographical and cognitive proximity (Markusen et al., 2011).
A great deal of work still remains to be done in the future. We intend to continue our research based on the relatedness approach and combined with the ecology of culture in an attempt to identify not only an 'industrial' space, but also an 'ecological' space for the creative industries. We also intend to explore their impact both on and 'beyond' the whole economy.

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