ESSAYS ON LOCATION PATTERNS OF CREATIVE INDUSTRIES

Eva Coll Martínez

UNIVERSITAT ROVIRA i VIRGILI

Essays on Location Patterns of Creative Industries

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Essays on Location Patterns of Creative Industries

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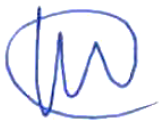
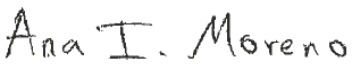
We STATE that the present study, entitled *Essays on Location Patterns of Creative Industries*, presented by Eva Coll-Martínez for the award of the degree of Doctor, has been carried out under our supervision at the Department of Economics of this university, and that it fulfils all the requirements to receive the European/International Doctorate Distinction.

Reus, December 4th 2017

Doctoral Thesis Supervisors





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Curiosity about life in all of its aspects, I think, is still the secret of great creative people.

– Leo Burnett

Art, freedom and creativity will change society faster than politics

– Victor Pinchuk

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When I finished my degree in Economics and was thinking about what to do with my life, professors **M. Ferré, R. Flores** and **B. Theilen** encouraged me to accept the challenge of a PhD in the Economics Department of the Rovira i Virgili University (URV). In fact, it seemed that my passion for studying was looking for an excuse to continue at the University, and the possibility of doing a PhD was an unexpected but very welcome opportunity.

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I will now leave you with these four years of research on the location patterns of creative industries summarised in 150 pages… But how is it possible for so many hours of research to be concentrated in such a small space? I guess that it is a matter of agglomeration economies… Well, I hope that you enjoy reading this thesis as much as I enjoyed doing it.

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Abstract

This thesis identifies and analyses which factors facilitate the location and agglomeration of creative industries at the local level and compares them to those of other economic activities. It contributes to the literature on creative industries by analysing the location behaviour of these industries using both a traditional analysis at municipality level and introducing some innovations regarding the use of spatial econometrics, distance-based methods and Geographical Information Systems (GIS) thanks to the availability of micro-geographic data. The empirical application focuses on Catalan municipalities for the period 2002-2007, the Metropolitan Area of Barcelona and the city of Barcelona for the period 2006-2015. The main findings show that, although the location determinants of creative industries are not so different from those of non-creative industries, the specific nature of these industries and their greater need for agglomeration is confirmed, especially for symbolic-based creative industries. Moreover, this thesis confirms the positive association between creative industries and economic growth – in terms of firm creation or productivity. Finally, it also suggests that the ability to attract creative activities and employment to an area strongly depends on the existing *creative milieu* and the cultural path dependence of the area. On the basis of the assumption that creative industries have great potential in terms of, for example, economic dynamism, urban regeneration or city marketing, the results given here suggest a series of recommendations for public authorities willing to support the diversification of economic activity for the purpose of enhancing their competitiveness in an increasingly global economic and social context.

Keywords: creative industries, *creative milieu*, agglomeration, location decision, productivity

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Chapter 1

Introduction

The fuzzy concept of creativity has become a major topic of research in a wide variety of fields over the last twenty years. The origins of this literature can be traced back to the analysis of cultural industries (Throsby 2001; Benhamou 2001; Towse 2003). This analysis was subsequently redirected to creative industries (Cunningham 2002). Creative industries (CIs) are those industries that produce and commercialise creative services and products. Several international organisations (DCMS 2001, 2013; OECD 2007; UNCTAD 2010; UNESCO 2013) and academics (Caves 2000; Florida 2002a; Markusen et al. 2008) have helped to establish a definition of CIs.

This thesis relies on UNCTAD's definition (2010), as it is one of the most widely accepted in this literature and it also includes a wider range of industries. According to this definition, CIs are a set of economic activities that use creativity as the main input and which provide tangible or intangible goods or services with creative content and economic value potentially generating revenues from trade and intellectual property rights. More specifically, CIs include activities such as arts, advertising, cinema, fashion, publishing, R&D or software. However, there has been an extensive debate in the literature on what activities should be regarded as CIs (Lazzeretti and Capone 2015; Bakhshi and Cunningham 2016). Some authors claim that the nature of work in these kinds of industry is not necessarily creative. This ambiguity of classifications could be due to the fact that 'some creative products have a dual nature that divides their process in an intangible and a physical part, both with differentiated characteristics' (Boix-Domenech 2013 p. 67). Nevertheless, defining a closed list of CIs is a complex task and that is beyond the scope of this thesis. [1]

The growing interest in CIs stems from governments' need to redirect their economies and societies towards creativity in order to respond to continuous technological advances, the economic crisis of traditional sectors and new patterns of consumption in an increasingly globalised world (UNCTAD 2010; Flew 2010). In this new economic context, policy makers have seen CIs as new sources of local economic growth, development and competitiveness because of their role in the reconfiguration of innovation and industry (Evans 2009; European Commission 2010; UNCTAD 2010; Potts 2011). However, other economic activities may also lead to economic growth and competitiveness by means of innovation (Lee 2014; Pareja-Eastaway 2016). Nevertheless, CIs are

[1] See Sánchez-Serra (2016) for an accurate review of definitions of CIs and classifications and Cruz and Teixeira (2015b) for an analysis of the consequences of using different CIs classifications.

characterised by a greater adaptability to change, a higher propensity for creative destruction and a greater adaptability to the new demands (Potts 2011), which makes CIs an important policy tool for rising to the new challenges arising in this new economic paradigm.

This thesis takes a broad view of creativity and it conceives CIs as a set of economic activities that use creativity as the main input and as a mechanism for overcoming the challenges arising from a new economic context. The main aim of this thesis is to analyse and identify which factors facilitate the location and agglomeration of CIs at the local level and to compare them to those of other economic activities. In doing so, it contributes to the literature on CIs by making a traditional analysis of the location behaviour of these industries at municipality level and by introducing some innovations regarding the use of spatial econometrics, distance-based methods and Geographical Information Systems (GIS), made possible by newly available micro-geographic data.

This thesis focuses on Catalonia, a Mediterranean region with a longstanding industrial tradition that has been redirected to a more knowledge-based and creative economy over the last fifteen years (Boix-Domenech 2012). In this regard, Catalonia, and specially its capital Barcelona, has become one of the most important creative hubs in Europe in terms of employment in CIs (IERMB 2013). These factors explain why Catalonia is a perfect case for analysing the location behaviour of these industries and the impact they have had on the local economy over these years. On the basis of the assumption that CIs have great potential in terms of, for example, economic dynamism, urban regeneration or city marketing, the results given here should serve as a basis for making a series of recommendations for public authorities willing to support the diversification of economic activity for the purpose of enhancing their competitiveness in an increasingly global economic and social context.

The increasing importance of CIs has been reflected in an increase in the number of publications in various areas of study (Lazzeretti et al. 2017), one of the most important of which is the spatial organization of CIs (see, for example, Cooke and Lazzeretti 2008, O'Connor 2010, or Chapain and Communian 2010). Most of these contributions focus on the spatial analysis of creativity and the reasons for the clustering of CIs (see for instance, Lazzeretti et al. 2008, De Propris et al. 2009, Bakhshi et al. 2013, Sánchez-Serra 2016, or Gong and Hassink 2017). Others have investigated the link between the agglomeration of CIs and local development (i.e., Foord 2009; De Miguel-Molina et al. 2012). However, there are still some open questions in this literature.

In practice, because of the potential CIs have for generating a creative environment that can attract new firms and highly-skilled workers and, at the same time, improving the competitiveness of local economies (Florida 2002a; Scott 2004; De Propris 2013), many scholars have attempted to link CIs with economic growth but, unfortunately, few of them have been able to fully capture the effect of creative environments, that is, an unobservable *creative milieu* (Wojan et al. 2007b). Moreover, despite

the fact that the agglomeration patterns of CIs is one of the most widely analysed topics in the literature (O'Connor 2010; Lazzeretti et al. 2012), very few papers have considered how the concentration of employment in CIs can benefit a specific area in terms of attracting new firms (see for instance, Lee et al. 2004; Stam et al. 2008, McGranahan et al. 2010 or Cruz and Teixeira 2014a).

The thesis is structured as follows. The second and third chapters make a municipality-level analysis to determine the location determinants of CIs and the effects of creative environments on economic dynamism. The fourth chapter provides an exhaustive intra-metropolitan analysis of the agglomeration patterns of CIs in the Metropolitan Area of Barcelona (MAB). The thesis finishes with an in-depth analysis of the effects of agglomeration economies on the performance of CIs firms in the city of Barcelona.

The second chapter of this thesis, which has already been published in Environment and Planning A (Coll-Martínez and Arauzo-Carod 2017), studies the role played by the existing spatial distribution and agglomeration economies of CIs in their location decisions. In particular, it asks whether specialisation in CIs enhances the location of all kinds of firm and if an unobservable *creative milieu* that favours the agglomeration of bohemians also favours the location of firms. It uses Count Data Models and data from Catalan municipalities, to show that location determinants are quite similar in both creative and non-creative industries and that both industries are positively influenced by the specialisation level of CIs. Moreover, results provide evidence that an unobservable *creative milieu* has a considerable impact on attracting firms. These results are in line with Scott (2000), Lee et al. (2004), Stam et al. (2008) and Cruz and Teixeira (2014a), and support the association between the concentration of creative workers and the creation of new firms at a municipality level. Indeed, these results also support the positive association between entrepreneurship and an unobservable *creative milieu* reported by Lee et al. (2004) and Wojan et al. (2007b). Thus, this chapter contributes to the literature by shedding light on the relationship between creative environments and economic dynamism.

As stated above, although most contributions suggest that CIs enhance economic outcomes, unfortunately, very few have been able to fully capture their effect without being susceptible to endogenous causation. This is because CIs may also be attracted to already successful areas (Hall 2000; Markusen 2006, 2010). In this regard, Lee (2014) made an initial attempt to deal with this causal relationship by using instrumental variables (IV). The results, however, are still inconclusive. Moreover, despite the potential of CIs enhance the location of economic activity, the conditions for creating or stimulating creative regions are highly path dependent in terms of the urban history and the cultural dynamics that shape the particular identity of the municipality (Landry 2000; Florida 2002a; Scott 2006; Pareja-Eastaway and Pradel-i-Miquel 2014).

In this regard, the third chapter of this thesis aims to shed light on the role played by the spatial concentration of these kinds of activity on new firm creation. To approach this issue of potential reverse causality, this chapter uses data from Catalan municipalities and an IV approach. In particular, it argues that some of the local factors arising from the foundation of cultural associations in the nineteenth and twentieth centuries may still influence the present concentration of creative employment in these municipalities. By using the foundation of cultural associations as historical IVs, the results confirm the potential of CIs for new firm creation. These results are in line with the findings of Lee (2014) and Wojan et al. (2007b), which support the positive association between new firm creation and an unobservable *creative milieu*. Indeed, these results also support the association between the concentration of employment in CIs and the entry of new firms at a municipality level (Scott 2000; Lee et al. 2004; Stam et al. 2008), and emphasise the role of cultural dynamism path patterns and a strong identity (Pareja-Eastaway and Pradel-i-Miquel 2014). Thus, this chapter contributes to the literature on CIs by suggesting that the conditions for creating or stimulating creative cities are dependent on cultural path dependency and the historical context of municipalities.

A widespread claim in the literature on the location patterns of CIs is that CIs have a greater need for agglomeration than non-CIs due to their intrinsic characteristics and the fact that their work nature requires constant explicit and tacit contact within formal and informal networks (Scott 1997; Scott et al. 2001; Asheim et al. 2007; Andersson et al. 2014). In this regard, geographical proximity facilitates the exchange of knowledge, particularly if knowledge is tacit and context-specific as it is in the case of CIs (see, for instance, Scott 1997, Banks et al. 2000, Lazzeretti et al. 2008, 2012 or Plum and Hassink 2014). However, agglomeration externalities, especially those associated with knowledge spillovers, are known to decay rapidly over space (Rosenthal and Strange 2008; Arzaghi and Henderson 2008). The intensity and spatial extent of the agglomeration and coagglomeration of CIs within urban areas has not yet been clearly identified in the literature due to the common use of area-based methods (Cooke and Lazzeretti 2008; De Propris et al. 2009; Lazzeretti et al. 2012).

The fourth chapter, which has already been published in *Papers in Regional Science* (Coll-Martínez et al. 2017), evaluates the intensity and extent of agglomeration and coagglomeration of CIs in the MAB. It argues that the agglomeration of CIs should be more intense and decay more rapidly over distance than in other industries, and that these results may depend on the dominant knowledge base in each creative sector. It uses firm-level geo-located data to calculate distance-based M- and m-functions of agglomeration and coagglomeration. The results show that CIs are relatively more agglomerated than non-CIs at short distances, and that each individual CI sector displays high levels of agglomeration (especially symbolic-based sectors). Also, the coagglomeration of CIs and non-CIs is only observed for micro-firms and there is significant coagglomeration among symbolic-based CI sectors. These results confirm the theoretical discourse that CIs have a greater need for spatial

proximity than non-creative activities (Scott 1997; Scott et al. 2001) and that the tendency of CIs to coagglomerate remains consistent wherever they locate (Currid and Williams 2010). They also complement the findings of Boix-Domenech et al. (2015), which is the only study to date to apply a continuous space method to deal with the agglomeration and coagglomeration of CIs. This chapter contributes to the literature by taking advantage of the capacity of M- and m-functions to test the statistical significance of the results at each distance and by estimating the intensity and extent to which CIs agglomerate and coagglomerate compared to other activities in the city.

Having estimated the intensity and extent of the agglomeration of CIs, the literature on CIs still leaves some questions unanswered. Some scholars point out that CIs agglomerate and coagglomerate similarly in whichever city they locate in because firms have access to a wider range of consumers' preferences and higher average consumption levels of cultural goods and services in city centres (Heilbrun 1996; Glaeser et al. 2001; Turok 2003; Currid and Williams 2010). Moreover, the actual effect of the spatial extent of agglomeration economies on the productivity of creative firms within urban areas has not yet been analysed in the existing literature (e.g., Cooke and Lazzeretti 2008; De Propris et al. 2009; Lazzeretti et al. 2012; Boix-Domenech et al. 2015).

In this context, the fifth chapter of this thesis attempts to infer the spatial extent of agglomeration economies for the creative service industries (CSIs) in Barcelona and its relationship with firms' performance controlling for urban characteristics and demand factors. Using micro-geographic data of firms between 2006 and 2015, GIS techniques are used to estimate the effect on productivity of intra-industry and inter-industry agglomeration in rings around location in Barcelona. The main results show that for symbolic-based CSIs localisation economies – mainly understood as networking and knowledge externalities – have positive effects on Total Factor Productivity (TFP) at short distances, while for the two other knowledge-based CSIs (i.e., synthetic and analytical) localisation economies seem not to be so relevant. Moreover, the results show that market potential does not offset localisation economies for CSIs. These results are in line with those of Arzaghi and Henderson (2008) – showing that there is an extremely fast spatial decay of agglomeration effects – and with the claim of Currid and Williams (2010) that the tendency of CIs to coagglomerate in city centres remains consistent wherever they locate. Moreover, these results suggest the importance of networking or information spillover effects for some creative activities, especially, for symbolic-based CSIs. Thus, this chapter contributes to the literature on CIs by using GIS techniques and distance-based methods to make an in-depth analysis of the agglomeration effects on firm productivity when market potential effects are taken into account.

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Chapter 2

Creative milieu and firm location: An empirical appraisal [2]

1. Introduction

The study of the location determinants of manufacturing firms has become much more attractive to researchers in recent years and there has been a considerable increase in publications in this area (see Arauzo-Carod et al. 2010, for a review of the empirical literature). However, although location issues are receiving more attention, scholars have hardly focused on the creative industries (CIs). CIs are a set of knowledge-based activities that use creativity as the main input and which provide tangible or intangible goods or services with creative content and economic value potentially generating revenues from trade and intellectual property rights (UNCTAD 2010). They include the following activities: Advertising, architecture, arts, crafts, design, designer fashion, cinema, interactive leisure software, music, television and radio, performing arts, publishing and software.

In light of this global interest, the location specificities of these industries have emerged as an interesting object of study, particularly since several theoretical and empirical studies have emphasized the importance of CIs as factors in local economic growth and development (see Power and Scott 2004 and UNCTAD 2008, 2010, among others). These industries are also believed to enhance the image and prestige of their host areas, which more readily attract new investors and creative workers (Florida 2002a). Moreover, the entry of creative firms should lead the diversification and competitiveness of local economies (De Propris 2013; Scott 2004). For these reasons many scholars have attempted to link creative environments with economic growth but, unfortunately, few of them have been able to fully capture their effect without being susceptible to endogenous causation. Firstly, most studies have analysed the agglomeration patterns of CIs, but few of them have considered how the concentration of creative workers can benefit a specific area in terms of attracting new firms (see for instance, Lee et al. 2004 and McGranahan et al. 2010). Secondly, nothing has been said in the literature about whether the location determinants of creative firms differ from those of other manufacturing firms. And thirdly, there are still some

[2] The paper in this chapter is coauthored with J.M. Arauzo-Carod. It has already been published in the Environment and Planning A, 49(7): 1613-1641.

difficulties in defining and measuring this unobservable *creative milieu*. All these shortcomings hamper the setting-up of clear policies to promote CIs. This chapter aims to shed light on the relationship between creative environments and economic growth, and provide empirical evidence for the effects that creative environments have on the location decisions of firms. Specifically, this chapter addresses three research questions: 1) Are the determinants of the location decisions for creative and non-creative firms substantially different? 2) Is the specialisation in creative sectors a driving force for the location of firms in a municipality? 3) Does an unobservable *creative milieu* that favours the agglomeration of bohemians (individuals involved in the arts industry) increase the entry of firms?

The empirical application will focus on Catalan municipalities and use data from the REIC (Catalan Manufacturing Establishments Register), which contains plant-level microdata on the location of new manufacturing plants for the period 2002-2007. A dataset about the local characteristics of Catalan municipalities taken from Trullén and Boix-Domenech (2005), the Catalan Statistical Institute (IDESCAT 2001) and the Catalan Cartographical Institute are used.

Using Count Data Models, main results of this chapter show that creative and non-creative firms share similar location factors and they are both positively influenced by the specialisation level of the CIs in municipalities. However, taking neighbouring effects into account, this effect is found to be more spatially limited for creative and fashion firms whereas for non-creative firms and all firms it seems to be more geographically spread. Moreover, results suggest that an unobservable *creative milieu* has a considerable impact on the formation of new firms.

The chapter is structured as follows. In Section 2 the literature on location determinants is reviewed, with particular focus on the state of the art for CIs. In Section 3 the methods used are presented. In Section 4 the data is presented and in Section 5 the main results are discussed. Finally, in Section 6 main conclusions are summarised and some policy implications are discussed.

2. Literature review

Creative industries came to the fore after the publication of reports by the OECD (2007) and UNCTAD (2008) and the British Government's Creative Industries Task Force Mapping Document (DCMS 2001) in which CIs are defined as "activities which have their origin in individual creativity, skill and talent and which have the potential for wealth and job creation through generation and exploitation of intellectual property" (DCMS 2001 p. 5). However, some authors question the creative nature of this industry. The ambiguity of classifications could be explained by the fact that "some creative products have a dual nature that divides their process into an intangible and a physical part, both with differentiated characteristics" (Boix-Domenech 2013 p.

67). On the basis of previous methodological discussions it seems to be clear that defining a closed list of CIs is a complex task and beyond the scope of this chapter.

It is worth noting that since the seminal contribution by Florida (2002a) the location patterns of creative activities have gained significance. However, few studies have focused on the entry determinants of CIs. Most of the studies that have been made assume that cultural diversity fosters new firm creation. In this regard, Audretsch et al. (2010) find that higher levels of knowledge and cultural diversity positively affect the creation of technology-oriented firms in Germany. In the case of the US, Lee et al. (2004) find that open and creative areas favour a dynamic entrepreneurship climate. In a similar approach, De Jong et al. (2007) show that those areas with higher concentration levels of CIs have higher firm entry rates in the Netherlands. And among the most recent studies, Cruz and Teixeira (2014a) show that the location decisions of creative firms depend on the creative sector to which they belong and their own characteristics in Portuguese municipalities.

Although most of these contributions suggest that creative activities enhance economic outcomes, there is still some debate about the potential effect of reverse causality on these models, as CIs may also be attracted to successful areas (Hall, 2000; Markusen 2006, 2010). Even if in Lee (2014) this causal relationship is justified by exploring three mechanisms by which CIs may lead to economic growth, it seems that more theoretical and empirical studies dealing with this controversial issue are required.

The agglomeration patterns of creative firms have been widely analysed and it has been shown that CIs tend to cluster in specific places, but usually in cities (see Lazzeretti et al. 2012 and Maskell and Lorenzen 2004, among others). In particular, Lazzeretti et al. (2012) have described four different approaches that explain the agglomeration patterns of these industries. The first approach links the existence of historical and cultural heritage to the agglomeration of CIs (see Cinti 2008 and Scott 2000). The second approach relates the effect of agglomeration economies with the organization of industry (Ciccone and Hall 1996; Jacobs 1961, 1969; Ohlin 1933). The third approach relies on the concept of 'related variety' and its contribution to the clustering of creative activities in terms of knowledge spillovers between different subsectors (Boschma and Fritsch 2009). Finally, the fourth approach relies on Florida's (2002a) creative class concept (those workers whose economic function is to create new ideas, new technology or creative content) and on the 3T's theory. According to this theory there are some areas with high levels of Technology, Talent and Tolerance that act as poles for the creative class because they offer a *creative milieu* that attracts creative activities and high-skilled workers. However, some authors argue that the creative class is a fuzzy concept because of the way in which it is defined and the causal relationship it has with urban growth (Markusen 2006).

In line with all these approaches, municipalities specialised in CIs should be more able to attract new firms because of the agglomeration advantages created by the co-location of creative firms (localisation economies).[3] Moreover, municipalities specialised in CIs should generate knowledge spillovers in terms of creativity and innovation, leading to new business development and growth in other industries (Scott 2000; Lee et al. 2004; De Jong et al. 2007; Stam et al. 2008).

Hypothesis 1: Specialisation in CIs should enhance the location of all kind of firms, whether they are creative or not.

The aforementioned intangible *creative milieu*[4] has been used to suggest that there is a positive relation between the presence of the artistic workforce in a place and economic competitiveness. This conjecture relies on the idea that the spatial concentration of artists ensures a singular, open and diverse environment, which attracts other talented and high-skilled workers, resulting in human capital and business creativity (Florida 2002a and Lee et al. 2004). Although most studies attempting to measure this *milieu* simply rely on the share of employment in the arts as an explanatory factor of new firm formation, this association could be spurious if artists tend to concentrate in areas endowed with economic growth factors (Wojan et al. 2007a). In this sense, Wojan et al. (2007b) find an alternative way to measure this *creative milieu* by avoiding most of the main problems of the fuzzy concept of creative class (Markusen 2006). They use a two-step method in which first they regress the share of employment in arts, and then they use the residual of this regression to explain variations on some indicators of economic dynamism. Using US county level data, they show that this *creative milieu* has a positive impact (albeit a small one) on economic development.

In line with Wojan et al. (2007b), this chapters wonders whether there are some intangible characteristics that attract both businesses and artists to a particular municipality. Specifically, this chapter regards an unobservable *creative milieu* as a proxy measuring the image of a specific location that helps to attract creative talents and entrepreneurs (Hitters and Richards 2002). Although a *creative milieu* is difficult to measure because it is non-observable, it should be obvious to those individuals involved in the arts (bohemians) since creativity is the essential function of their job (Lloyd 2008; Andersson et al. 2014). For this reason, location decisions taken by bohemians should reveal this *creative milieu*. At the same time, this *creative milieu* can also attract the attention of the most creative and innovative firms and bring them to the area.

Hypothesis 2: An unobservable creative milieu that favours the agglomeration of bohemians also favours the location of firms.

[3] See Branzanti (2014) for a survey of studies focusing on district economies in the context of CIs.

[4] Some authors have tried to define it previously: for example, Landry (2000), Lazzeretti (2009) and Santagata and Bertacchini (2011).

3. Methods

3.1 Model specification

In order to analyse the determinants of the location decisions of firms and their relationship with CIs specialisation, the number of new and relocated establishments in a municipality is estimated as a function of the specific local characteristics:

$$Firm\ entries_{i(2002-2007)} = \beta_0 + \beta_1 ptech_{i(2001)} + \beta_2 puni_{i(2001)} + \beta_3 job\_den_{i(2001)} + \beta_4 job\_pop_{i(2001)} + \beta_5 job\_ser_{i(2001)} + \beta_6 job\_ind_{i(2001)} + \beta_7 psmall_{i(2001)} + \beta_8 job\_hk\_ser_{i(2001)} + \beta_9 sici_{i(2001)} + \beta_{10} dist\_pro_i + \beta_{11} cap\_com_i + \beta_{12} seaside_i + u_i \quad (1)$$

where *Firm entries*$_i$ is the number of plants located in a municipality *i*. The empirical strategy consists of estimating four different models that share the same set of explanatory variables with different dependent variables (Y_i): all firms (*entry_t*), non-creative firms (*entry_ncrea*), creative firms (*entry_crea*) and fashion firms (*entry_fashion*).[5] This strategy allows to compare the location determinants of the group of firms considered, with particular focus on the impact of a Specialisation Index in CIs (SICI)'s – a location quotient in CIs. [6]

In order to test the second hypothesis about the effects of an unobservable *creative milieu* on the location decision of firms, this chapter follows Wojan et al. (2007b). Concretely, a two-step procedure is applied: first, the location decision of bohemians[7] at municipality level is estimated:

$$Bohemians\ (2001) = \beta_0 + \beta_1 pcollege_{i(1991)} + \beta_2 income_{i(2001)} + \beta_3 foreign_{i(1996)} + \beta_4 gay\_index_{i(2001)} + \beta_5 heritage_{i(1996)} + \beta_6 pop\_density_{i(1996)} + \beta_7 commuting_{i(2001)} + \beta_8 pop91-01_{i(1991)} + v_i \quad (2)$$

The residual (v_i) of regression (2) contains all the unobserved effects associated with unobserved factors and white noise. The degree to which these unobserved effects can capture a *creative milieu* depends on the explanatory power of the model and on the appropriate specification of equation (2). This chapter assumes that this approach to a *creative milieu* effect can be susceptible to omitted variables problems, but it is the closest and clearest empirical approximation of a *creative milieu*. In

[5] Entries for all CIs and Fashion industries are only considered since other industry aggregations only had a few firms.

[6] The key variable SICI is substituted in the fashion firm model for SICI in the clothing sectors (*sici_fashion*) which include employment in sectors 177, 181, 182, 183, 181, 192 and 193.

[7] See section 4 for details about these explanatory variables. It should be taken into account that here artistic occupations (CCO-94) are used, which is different from employment in CIs (NACE-93) which is used to calculate the SICI index.

the second step, the approximation of an unobserved *creative milieu* (v_i) can be included in the main equation (1) as an additional explanatory variable (v^*_i):

$$Firm\ entries_{i(2002-2007)} = \beta x_{i(2001)} + \theta v^*_{i(2001)} + \varepsilon_i \quad (3)$$

Then, if the coefficient θ is positive and significant, the hypothesis of a common unobserved factor (i.e., a *creative milieu*) that attracts both bohemians and firms can be accepted.

Finally, in order to account for spatial dependence, a spatial neighbour matrix (*W*) is used to determine the spatially lagged counterparts of some of the independent variables.

$$Firm\ entries_{i(2002-2007)} = \beta x_{i(2001)} + \theta v^*_{i(2001)} + \delta W\_Z_{i(2001)} + e_i \quad (4)$$
$$Z = \beta x_{i(2001)} + \theta v^*_{i(2001)}$$

The main assumption is that location determinants should be measured over an area wider than a municipality, as firms consider these characteristics not only in the specific area (municipality) where they are located but also in the surrounding areas. In Section 3.2 a detailed explanation of this spatial strategy is provided.

3.1.1 Explaining firm entries

It is assumed that education (*ptech*, *puni*) is an important location factor whatever characteristics a firm may have. However, commuting flows may solve spatial mismatch in the labour market if there are appropriate transport infrastructures (Arauzo-Carod 2005). There is wide consensus about the more productive environment (which is preferred by firms) generated by agglomeration economies (*job_dens*, *job_pop*). The industrial mix (*job_ind*, *job_ser*) helps to capture the local economic structure as well as the availability of advanced services can (*job_hk_ser*). Similarly, the existence of a wide number of small firms (*psmall)* typically encourages firms to locate, as suggested by the Incubator Hypothesis (Garofoli 1994). Obviously, geography and institutional issues matter (Guimarães et al. 2000), as firms need good accessibility to services provided in cores, so it is necessary to control for the geographical position of the municipalities (*seaside*), their distance from main cities (*dis_pro*) and their institutional relevance (*cap_cou*). Finally, municipalities that are more specialised in CIs (*SICI*) should favour the entry of all kinds of firm. The results for this explanatory variable would allow to test the first hypothesis of this chapter.

Although some authors argue that adding human capital and creative class to the model could involve endogeneity problems (Glaeser 2004; Markusen 2006, 2010), this issue is avoided as it relies

on the specialisation of employment in CIs (defined by UNCTAD and DCMS) and not on the concept of creative class (which defines as creative those occupations requiring high levels of education). In fact, SICI attempts to capture the concentration of employment (with different levels of human capital) in those sectors in which creativity is very important for carrying out their activity.

3.1.2 Explaining bohemian location

Firstly, the number of bohemians is expected to be higher in municipalities in which the demand for arts and cultural assets is likely to be high. In this way, the proportion of the population enrolled in college (*pcollege*) and the median household income (*income*) (the income elasticity of demand for cultural assets tends to be high) should favour the location of bohemians. Secondly, the location decision of bohemians is determined by residential amenities proxied by the following variables: percentage of foreign born population (*foreign*) (as a measure of diversity and cosmopolitanism), number of gay couples (*gay_index*) (as a measure of tolerance, since higher concentrations of gay couples may reveal open-minded municipalities whose inhabitants approve of alternative lifestyles (Florida 2002a, 2002b) and the number of cultural assets of national interest[8] (*heritage*) (which are essential sources of inspiration for artists). Thirdly, artists are supposed to be mostly located in dense municipalities (*pop_density*) with a high availability of services (including cultural assets). The proportion of employed residents commuting outside the municipality (*commuting*) should have a negative impact on bohemians, because this involves a lower level of interaction. Finally, the change in residential population between 1991 and 2001 (*pop91-01*) may capture other local amenities or political and social factors not included in the specification.

All these estimates are presented for sub-samples of metropolitan municipalities (n=420), non-metropolitan municipalities (n=526), and all municipalities (N=946), by using a classification of metropolitan municipalities defined by Trullén and Boix-Domenech (2005) for Catalonia. Although creative workers are assumed to be concentrated in metropolitan areas, there are several exceptions. Therefore, by making this distinction it is possible to determine whether there are significant differences in location determinants between the two areas. The distinction also increases the likelihood of identifying a significant *creative milieu* effect (if it exists), since "the structural simplicity of non-metro economies imparts a more direct relationship between *creative milieu* and any observed dynamism" (Wojan et al. 2007b p. 712).

3.2 Model selection

[8] In alternative specifications other variables related to community amenities (such as number of museums and galleries, non-profit organizations, wineries, retailer shops), climate variables (such as temperature, precipitations, humidity), landscape (forest area) and tourism proxies (lodging size) were used but they were highly correlated with population density and the model's fit did not improve when they were included.

The Variance Inflation Factor (VIF), Collinearity Condition Number and correlation diagnostics are used to test whether collinearity and endogeneity are an issue in these models. VIF provides an index of how much the variance of an estimated regression coefficient is increased by collinearity. There is a multicollinearity problem whenever the VIF value is larger than 10. The Condition Number is computed by finding the square root of the maximum eigenvalue divided by the minimum eigenvalue. If the Condition Number is above 30, the regression may have significant multicollinearity. Concretely, with VIF and Condition Number values around 1 and 2 for all subsamples, the possibility of suffering from multicollinearity was rejected. Moreover, all potentially correlated variables (i.e., human capital and SICI) have correlation values around 0 (see Tables A.1. and A.2. in the Appendix A).

Count Data Models (CDM) have been in common use when dealing with this location phenomenon from a spatial point of view: i.e., when trying to explain how the local characteristics of different sites (e.g., municipalities, counties, regions) can influence firms' decisions. These CDM include the Poisson model (PM), the negative binomial model (NBM), the zero inflated Poisson model (ZIPM) and the zero inflated negative binomial model (ZINBM). PM seems to be the starting point, but it has two main problems: *overdispersion* and *excess of zeroes*. These can largely be solved using NBM, ZIPM and ZINBM. Following Cameron and Trivedi (1998, 2005) to determine which specifications are best for the data used in this chapter according to the following statistics: the Akaike information criterion (AIC), the Bayesian information criterion (BIC) and the Vuong test.[9]

The descriptive statistics of the dependent variables in the firm entry model showed signs of overdispersion and zero inflation. Specifically, zeroes were 34.67% for total entries, 35.20% for non-creative entries, 81.62% for creative entries and 91.12% for fashion entries. For this reason, a baseline specification using CDM was estimated and the specification with the best fit using the aforementioned selection tests was selected. Table 1 illustrates the results of these statistics and shows that the ZINBM performed best according to AIC and BIC. As the Vuong test also favoured the ZINBM over the NBM the ZINBM was used for all the firm entry specifications.

Table 1. Selection model's tests

[9] AIC and BIC are two standard measures based on the likelihood-ratio test of the restrictions that reduce one model to the other. The model with the smallest values of AIC and BIC will be chosen, because a higher likelihood is preferred (Cameron and Trivedi 2005). Vuong (1989) proposed a statistic regarding the significance of ZINBM (ZIPM) compared to NBM (PM) in terms of a significant difference from zero in the overdispersion parameter. Specifically, if the statistic is positive and larger than 1.96, the zero inflated model is preferred.

Model 1 (All firms)	AIC	BIC	Vuong test
Poisson	12,453.48	12,516.56	-
Negative binomial	4,747.717	4,815.649	-
Zero-inflated Poisson	10,815.14	10,887.93	6.85***
Zero-inflated negative binomial	4,576.929	4,654.565	5.84***
Model 2 (Non-Creative)	AIC	BIC	Vuong test
Poisson	11,819.01	11,882.09	-
Negative binomial	4,692.44	4,760.371	-
Zero-inflated Poisson	10,108.15	10,180.94	7.11***
Zero-inflated negative binomial	4,520.089	4,597.725	5.93***
Model 3 (Creative)	AIC	BIC	Vuong test
Poisson	1,686.002	1,749.081	-
Negative binomial	1,209.071	1,277.002	-
Zero-inflated Poisson	1,397.842	1,470.625	3.15***
Zero-inflated negative binomial	1,116.916	1,194.552	5.31***
Model 4 (Fashion)	AIC	BIC	Vuong test
Poisson	935.853	998.932	-
Negative binomial	675.331	743.262	-
Zero-inflated Poisson	715.209	787.992	3.03***
Zero-inflated negative binomial	635.697	713.333	3.53***

Notes: *** p<0.01; ** p<0.05; * p<0.1.

Neighbouring effects are also important. If the effects of the determinants of firm location decisions extend beyond the geographical limits of municipalities and this possible spatial dependence is not taken into account, then, results may be biased and inconsistent. To account for spatial dependence, the spatially lagged variables of the independent variables were considered (Spatial Lagged Model in the X (SLX)). Specifically, these are estimated as follows: W_Z = WZ, where Z is a matrix that contains the independent variables and W is an appropriate (row-standardised) spatial-neighbour matrix. These matrices can be designed using different approaches and this chapter follows the approach used by Arauzo-Carod and Manjón-Antolín (2012) for the same data and geographical area (i.e., a distance-based matrix with a neighbouring criterion of 60 km).

The bohemian model will be estimated by OLS unless spatial dependence tests – the Robust Lagrange Multiplier (LM) and Moran's I test – confirm that we should apply a Spatial Lag Model (SLM) or a Spatial Error Model (SEM) (see Anselin et al. 2004 for further details). These tests to the firm entry model to check for spatial dependence are also applied (see Table A.3.). For both models, the null hypothesis of spatial lag or error independence is tested using the OLS residuals and the weighting matrix (a distance-based matrix of 60km). The results indicate that there is no need to use SLM or SEM to estimate bohemian and firm entry models. So, the OLS specification is preferred for estimating bohemian location decision and ZINBM for estimating firm entry models. Concretely, the bohemian model is then estimated by using OLS with White's correction to the variance-covariance matrix for heteroscedasticity. However, as significant spatial autocorrelation

was found for some explanatory variables of firm entry models when Moran's I test was used, an SLX is applied.

To sum up, the estimation strategy of this chapter is as follows. First, the location determinants of the group of firms are compared, with particular focus on the impact of *SICI*. Then, the decision model for bohemian location is estimated in order to obtain its residual and include this residual in the first specification as an additional explanatory variable to proxy a *creative milieu* effect. Finally, spatial lagged variables are incorporated to account for spatial neighbouring effects.

4. Data

The data in this chapter are from Catalonia,[10] an autonomous region in north-eastern Spain whose capital is Barcelona. The data includes one dataset about the location of new plants (dependent variable) and another dataset about territorial characteristics (independent variables). The dataset about the location of new plants is the Register of Manufacturing Establishments of Catalonia (REIC), supplied by the Catalan Government (Ministry of Innovation, Universities and Enterprise), which has plant-level microdata on the location of new and relocated manufacturing plants.[11] This dataset includes 10,033 manufacturing plants with codes 011 to 930 that located in Catalonia between 2002 and 2007.

To define CIs, this chapter follows UNCTAD's proposal (2010) as it is broader in terms of the industries it includes. It is also the most widely accepted by researchers (see Boix-Domenech and Lazzeretti 2012, among others). It should be taken into account that some CIs involve manufacturing activities (e.g. clothing and printing), which cannot incorporate creative workers, but this chapter assumes that there is a creative factor which dominates the whole process. Although the analysis could be focused on the most creative component of industry (e.g., fashion design or publishing), some authors argue that both components (manufacturing and creation) should be

[10] Catalonia has about 7.5 million inhabitants (15% of Spain's population) and a surface area of 31,895 km². It accounts for 19% of the Spanish GDP.

[11] See Manjón-Antolín and Arauzo-Carod (2011) for a detailed analysis of the interrelations between locations and relocations using the same dataset. Their results show that the location patterns of both new and relocated firms are quite similar.

taken into account due to "their strong interrelation in terms of input-output linkages and spatial co-location" (Boix-Domenech 2013 p. 65).[12]

Therefore, 26 creative sectors are included with codes between 177 and 925 (see NACE-93 industry classifications in Table 2). In accordance with this criterion, REIC's dataset reports 798 new creative establishments.

Table 2. Creative firm entries (NACE-93 Classification)

Code	Creative industries	Entries 02-07
177	Manufacture of knitted and crocheted apparel	16
181	Manufacture of leather clothes	1
182	Manufacture of other wearing apparel and accessories	302
183	Dressing and dyeing of fur; manufacture of articles of fur	17
191	Tanning and dressing of leather	1
192	Manufacture of luggage handbags and the like saddlery and harness	13
193	Manufacture of footwear	1
221	Publishing	6
222	Printing and service activities related to printing	322
223	Reproduction of recorded media	7
362	Manufacture of jewellery and related articles	63
363	Manufacture of music instruments	4
365	Manufacture of games and toys	9
366	Other manufacturing activities (as costume jewellery)	7
642	Telecommunications	0
721	Hardware consultancy	0
722	Software consultancy and supply	0
731	Research and experimental development on natural sciences and engineering	0
732	Research and experimental development on social sciences and humanities	0
742	Architectural and engineering activities and related technical consultancy	21
744	Advertising	1
748	Other economic activities (as photography and design)	6
921	Motion picture and video activities	2
922	Radio and television activities	0
924	News agency activities	0
925	Library archives, museums and other cultural activities	0
	Total creative firm entries	798

Source: Own elaboration with data from the REIC and IDESCAT

The dataset of the local characteristics of all 946 Catalan municipalities is mainly taken from Trullén and Boix-Domenech (2005), the Catalan Statistical Institute (Census 2001, IDESCAT) and the Catalan Cartographical Institute. Table 3 shows some descriptive statistics of these variables.

[12] In order to account for both components Boix-Domenech (2013) differentiates between "pure CIs" and "semi-CIs". Pure CIs can include activities such as publishing and design, while semi-CIs involve activities such as printing and clothing.

Table 3. Descriptive statistics for firm entries model

Variable	Definition	Source	N	Mean	Sd	Min	Max
entry_t	Total number of entries of firms (02-07)	REIC	946	10.606	37.946	0.000	810
entry_crea	Total number of entries of creative firms (02-07)	REIC	946	9.762	32.813	0.000	691
entry_ncrea	Total number of entries of non-creative firms (02-07)	REIC	946	0.844	6.288	0.000	133
entry_fashion	Total number of entries of fashion firms (02-07)	REIC	946	0.371	4.345	0.000	125
Human capital							
ptech	Education: Technical studies relative to number of jobs	IDESCAT (2001)	946	0.158	0.051	0.000	0.364
puni	Education: Graduate relative to number of jobs	IDESCAT (2001)	946	0.163	0.062	0.023	0.500
Agglomeration economies							
job_den	Jobs density	IDESCAT (2001)	946	0.171	0.669	0.000	8.991
job_pop	Ratio of number of jobs per population	IDESCAT (2001)	946	0.437	0.050	0.000	0.582
Industrial mix							
job_ser	Percentage of service employment	IDESCAT (2001)	946	0.473	0.259	0.000	1.000
job_ind	Percentage of industrial employment	IDESCAT (2001)	946	0.222	0.116	0.000	0.610
psmall	Percentage of small firms in the municipality	IDESCAT (2001)	946	0.837	0.237	0.000	1.000
job_hk_ser	Percentage of employment in high-knowledge services	IDESCAT (2001)	946	0.061	0.103	0.000	0.825
Creativity							
sici	Specialisation Index in creative industries	Own calculations	946	0.522	0.571	0.000	5.195
sici_fashion	Specialisation Index in fashion industries	Own calculations	946	1.029	1.839	0.000	20.377
creative_milieu	*creative milieu* residual from bohemian model	Own calculations	946	0.000	0.611	-2.147	4.087
Geography and administration							
dist_pro	Distance to the province capital (in thousands)	Trullén and Boix (2005)	946	43.307	27.409	0.000	135.881
cap_com	It indicates if the municipality is a capital of county (1) or not (0)	Trullén and Boix (2005)	946	0.043	0.204	0.000	1
seaside	It indicates if the municipality is beside the sea (1) or not (0)	Trullén and Boix (2005)	946	0.074	0.262	0.000	1

Table 4. Descriptive statistics for bohemian model

Variable	Definition	Source	N	Mean	Sd	Min	Max
bohemians	Arts employment (Ln)	IDESCAT (2001)	946	0.614	1.019	0	8.216
pcollege	Percentage of 20-24 population enrolled in college (Ln)	IDESCAT (1991)	946	0.009	0.006	0	0.044
income	Average income tax for taxpayer (Ln)	IDESCAT (2001)	946	9.072	0.369	7.664	10.401
foreign	Percentage of population foreign born (Ln)	IDESCAT (1996)	946	0.013	0.017	0	0.171
gay_index	Number of gay couples (Ln)	INE (2001)	946	0.264	0.635	0	6.538
heritage	Number of cultural assets of national interest (Ln)	IDESCAT (1996)	946	3.878	0.584	1.945	4.897
pop_density	Population density (Ln)	IDESCAT (1996)	946	3.769	1.856	-0.198	9.849
commuting	Percentage of commute outside municipality (Ln)	IDESCAT (2001)	946	0.408	0.073	0.273	0.572
pop91-01	Change in population from 1991 to 2001 (Ln)	IDESCAT (1991 and 2001)	946	0.109	0.246	-1.985	1.397

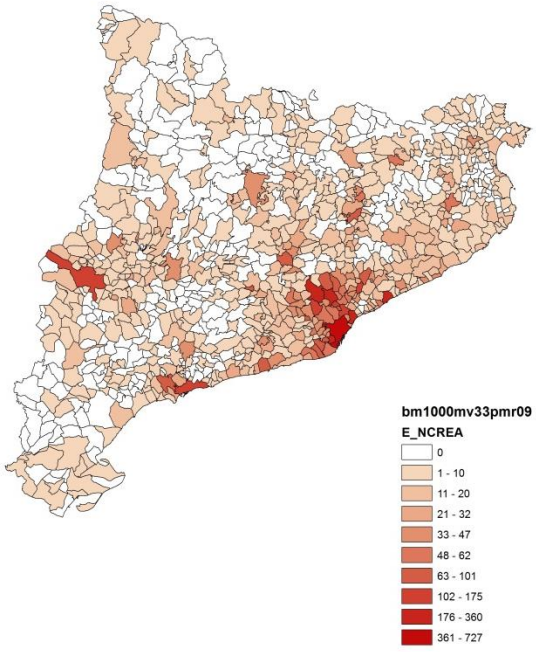
Regarding bohemian model, the dependent variable is the number of bohemians. Bohemians are defined as those employees closely related to such artistic jobs. This measure of bohemians includes those from code 251 of the CCO-94 Professional Categories Classification (Census 2001, IDESCAT)[13] just as Wojan et al. (2007b) and Florida (2002a) do.[14] Regarding explanatory variables they are also from Census 1991 and 2001 and Population Statistics 1996 (IDESCAT and INE). Most of them are calculated using data from 1996 or 1991 (depending on availability) in order to prevent any correlation with the error term. Descriptive statistics for these variables are provided in Table 4.

4.1 Spatial distribution of creative industries and SICI index

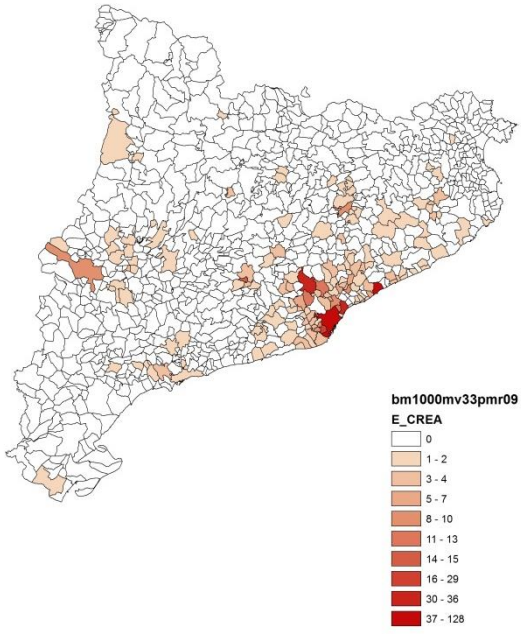
Figure 1 compares the location patterns of creative and non-creative firms. Although most of them agglomerate around Barcelona, non-creative firms are slightly more geographically dispersed whilst CIs tend to be slightly more clustered. Non-creative firms tend to locate near the larger capitals and where manufacturing activity and population are concentrated.

Figure 1. Spatial distribution of new plants (2002-2007) by Non-CIs and CIs

1.1. Non-Creative



2.2. Creative



Source: Own elaboration with data from REIC.

[13] For this reason industry with code 923 is not considered (this sector partially includes all professionals involved in Sector 251 CCO-94) in the classification of CIs in order to avoid endogeneity problems.

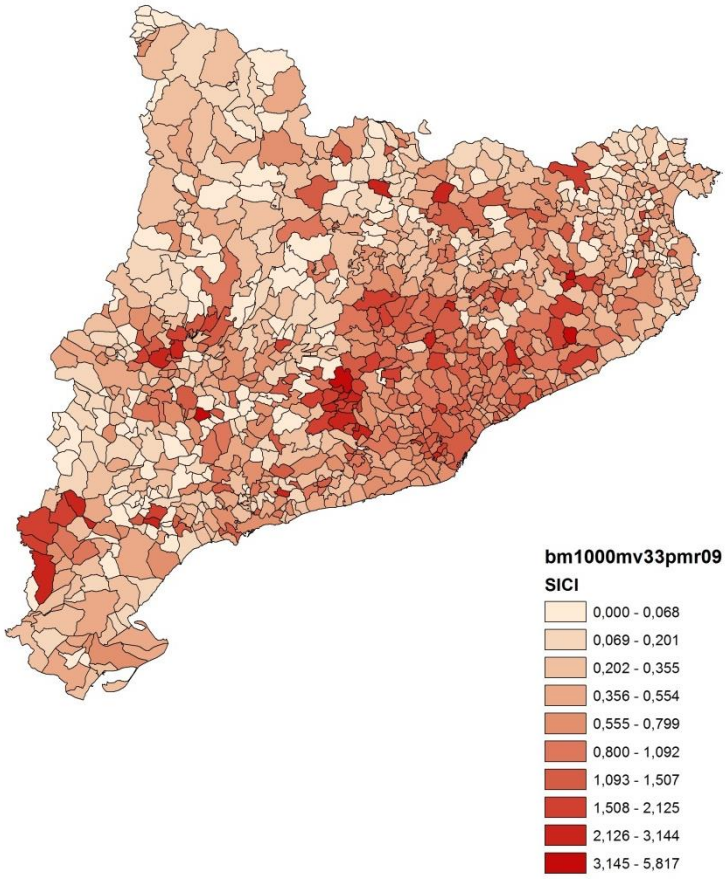
[14] See also Andersson et al. (2014), Markussen (2006), Lee et al. (2004) and Florida (2002b) for related approaches.

In order to find a location pattern for CIs in Catalonia SICI is calculated using data from the 2001 Census. The same index has been used for other scholars before but under different specifications (for example, Lazzeretti et al.'s Location Quotient (2012)). This index compares the relative specialisation of a municipality in a sector in relation to the national (Catalan) average and is defined as:

$$SICI_{ij} = (L_{ij}/L_j) \,/\, (L_i/\mathrm{L})$$

where L_{ij} is the workforce in the creative industry j in a municipality i, L_j is the total workforce in the creative industry j, L_i is the total workforce in a municipality i, and L is total employment in the area (Catalonia). A SICI above 1 indicates that the clustering of a creative industry j in a municipality i is larger than the national average, so the municipality is specialised in CIs.[15]

Figure 2. Spatial distribution of specialisation index in creative industries



Source: Own elaboration with data from 2001 Census.

[15] The SICI Index does not take into account employment in CIs 366 and 748, since this level of aggregation involve some non-creative activities, or 923, to avoid endogeneity problems with the bohemian model.

Figure 2 shows the spatial distribution of SICI. Generally speaking, higher SICI values are reported near the Metropolitan Area of Barcelona (MAB) whilst inland and mountain areas tend to have values below 0.6. In these latter areas, municipalities are less populated, so they have a less diversified industrial structure, which prevents them from developing an environment conducive to enhance CIs.

5. Results: *SICI* and *creative milieu* effects on firm location

The results for the first model are shown in Table 5. For all firms and non-creative firms all the explanatory variables are significant. More specifically, job density, as a proxy of agglomeration economies, acts positively; longer distances to provincial capitals reduces entries whilst seaside and county capital municipalities increase entries; manufacturing and service workforce shares increase entries but SME shares reduces them, which shows that these firms do not favour start-ups (see Arauzo-Carod and Manjón-Antolín 2012). Educational characteristics have opposite effects because technical studies are positive for firm location while higher educational levels are negative[16], as is shown by many other analyses (see, for instance, Arauzo-Carod and Manjón-Antolín 2004 and Arauzo-Carod and Viladecans-Marsal 2009, among others). Finally, the results show that specialisation in CIs is significant for all firms and non-creative firms, which supports the hypothesis that municipalities specialised in CIs are more likely to attract new businesses.

Returning to the issue of possible endogeneity, some authors argue that human capital can capture the effects of the concentration of creativity (Glaeser 2004). However, these results show that the effects of CI concentration on the creation of new firms are still significant when human capital variables are added.

[16] The role played by human capital as a location determinant of firms is quite ambiguous. Empirical evidence for the Catalan case (see, for instance, Arauzo-Carod 2005 and 2013) indicates that its influence depends on the characteristics of the firm. For a detailed analysis of the effect of different types of human capital on firms' location decisions, see Arauzo-Carod (2013).

Table 5. Location determinants of firms (ZINBM)

	All firms			Non-creative			Creative			Fashion		
Firm Entries	(1) Total	(2) Metro	(3) Non_Metro	(1) Total	(2) Metro	(3) Non_Metro	(1) Total	(2) Metro	(3) Non_Metro	(1) Total	(2) Metro	(3) Non_Metro
ptech	4.007***	0.488	5.648***	4.102***	0.498	5.759***	2.893	0.450	-1.591	-2.774	-5.138	-20.86**
	(1.102)	(2.044)	(1.358)	(1.109)	(2.049)	(1.362)	(2.847)	(4.316)	(4.503)	(4.951)	(7.352)	(9.523)
puni	-1.689**	-1.942*	-2.345	-1.581*	-1.741	-2.310	-2.767*	-3.686**	3.126	0.167	0.111	19.12***
	(0.850)	(1.104)	(1.475)	(0.846)	(1.085)	(1.480)	(1.587)	(1.824)	(3.935)	(2.540)	(2.862)	(6.662)
job_den	0.326***	0.206***	1.832***	0.309***	0.192**	1.796***	0.295***	0.193**	0.315	0.372***	0.354***	-0.156
	(0.084)	(0.078)	(0.510)	(0.082)	(0.075)	(0.502)	(0.083)	(0.079)	(0.429)	(0.127)	(0.116)	(0.470)
job_pop	4.661***	2.361*	7.701***	4.438***	2.102*	7.555***	9.181***	6.206	11.36**	9.045	2.294	6.514
	(0.959)	(1.269)	(1.571)	(0.960)	(1.258)	(1.577)	(3.095)	(3.877)	(4.746)	(5.667)	(7.883)	(8.218)
job_ser	0.860***	0.766	0.391	0.819***	0.678	0.357	0.374	-0.384	0.914	-0.779	-2.595	3.097
	(0.290)	(0.505)	(0.342)	(0.292)	(0.505)	(0.343)	(0.783)	(1.054)	(1.124)	(1.297)	(1.734)	(2.497)
job_ind	3.908***	5.611***	1.849**	3.884***	5.579***	1.805**	3.694***	4.609**	2.913	3.481	3.900	3.752
	(0.595)	(1.002)	(0.729)	(0.594)	(0.987)	(0.731)	(1.306)	(1.869)	(1.889)	(2.207)	(3.288)	(3.352)
psmall	-1.380***	-1.254***	-1.032***	-1.367***	-1.294***	-1.035***	-0.655	-0.748	0.401	-1.146	-1.267	-2.175
	(0.244)	(0.368)	(0.316)	(0.244)	(0.363)	(0.316)	(0.518)	(0.659)	(0.848)	(0.877)	(1.121)	(1.554)
job_hk_ser	3.233***	4.744***	1.315	3.190***	4.681***	1.309	5.565***	6.202***	4.425*	7.307***	7.602***	3.451
	(0.704)	(1.018)	(0.852)	(0.699)	(0.999)	(0.847)	(1.413)	(1.736)	(2.543)	(2.229)	(2.796)	(4.017)
sici [a]	0.348***	0.313*	0.129	0.293**	0.226	0.0799	0.818***	1.192***	0.677***	-	-	-
	(0.116)	(0.176)	(0.131)	(0.116)	(0.170)	(0.132)	(0.191)	(0.294)	(0.191)			
sici_fashion	-	-	-	-	-	-	-	-	-	0.406***	0.581***	0.408***
										(0.099)	(0.163)	(0.078)
dist_cappro	-0.0113***	-0.00935**	-0.0101***	-0.011***	-0.009**	-0.010***	-0.015***	-0.021**	-0.008	-0.013	0.005	-0.019
	(0.002)	(0.005)	(0.003)	(0.002)	(0.005)	(0.003)	(0.005)	(0.009)	(0.007)	(0.008)	(0.016)	(0.015)
cap_com	0.953***	0.769**	1.206***	0.933***	0.755**	1.191***	0.697***	0.610*	0.646	0.005	0.001	-0.624
	(0.192)	(0.305)	(0.239)	(0.190)	(0.296)	(0.237)	(0.259)	(0.340)	(0.418)	(0.418)	(0.509)	(0.791)

Cont. Table 5. Location determinants of firms (ZINBM)

	All firms			Non-creative			Creative			Fashion		
Firm Entries	(1) Total	(2) Metro	(3) Non_Metro	(1) Total	(2) Metro	(3) Non_Metro	(1) Total	(2) Metro	(3) Non_Metro	(1) Total	(2) Metro	(3) Non_Metro
seaside	0.729***	0.704***	0.785***	0.700***	0.664***	0.776***	0.737***	0.877***	0.248	1.109***	0.838**	-0.857
	(0.151)	(0.193)	(0.237)	(0.150)	(0.188)	(0.236)	(0.242)	(0.274)	(0.586)	(0.366)	(0.412)	(1.172)
Constant	-0.982*	0.187	-2.208***	-0.880	0.395	-2.143***	-6.013***	-3.975*	-8.193***	-5.903**	-1.785	-5.213
	(0.554)	(0.844)	(0.818)	(0.554)	(0.829)	(0.820)	(1.643)	(2.195)	(2.593)	(2.729)	(3.802)	(3.666)
Inflated variables												
pop	-6.194***	-7.149***	-5.854***	-5.189***	-4.721***	-5.664***	-1.623***	-0.667***	-3.294***	-1.442***	-0.333***	-3.959***
	(1.114)	(2.145)	(1.380)	(0.954)	(1.123)	(1.337)	(0.457)	(0.240)	(0.912)	(0.552)	(0.109)	(1.502)
constant	1.704***	2.358***	1.433***	1.501***	1.784***	1.394***	2.797	1.821***	4.416	2.851***	1.972***	6.406***
	(0.320)	(0.633)	(0.387)	(0.295)	(0.437)	(0.380)	(0.525)	(0.494)	(0.938)	(0.747)	(0.476)	(1.958)
Vuong Test	5.84***	5.04***	3.80***	5.93***	5.26***	3.80***	5.31***	3.73***	3.64***	3.53***	2.77***	1.77**
N	946	420	526	946	420	526	946	420	526	946	420	526
Non zero obs.	618	319	299	613	315	298	174	122	52	84	62	22
LR X^2	643.41	316.01	243.06	613.08	300.67	234.88	239.72	161.32	63.90	129.58	85.44	63.25
Log likelihood	-2,272.465	-1,250.325	-990.462	-2,244.045	-1,231.368	-979.616	-542.458	-377.379	-151.516	-301.848	-219.714	-59.685
AIC	4,576.929	2,532.651	2,012.924	4,520.089	2,494.736	1,991.233	1,116.816	786.759	335.033	635.697	471.428	151.371
/lnalpha	0.0146	-0.0784	-0.0948	-0.0140	-0.142	-0.107	-0.0644	-0.283	-0.876	0.688***	0.174	-16.15
	(0.069)	(0.089)	(0.115)	(0.071)	(0.091)	(0.116)	(0.168)	(0.207)	(0.558)	(0.230)	(0.327)	(1,168)
alpha	1.015	0.925	0.909	0.986	0.868	0.898	0.937	0.754	0.416	1.989	1.189	0.000
	(0.069)	(0.083)	(0.105)	(0.069)	(0.0793)	(0.105)	(0.157)	(0.156)	(0.232)	(0.457)	(0.389)	(0.000)

Notes: *** p<0.01; ** p<0.05; * p<0.1.Standard errors in parentheses.[a] SICI excluding artists.

The locational patterns of creative firms are quite similar. In terms of territorial characteristics, creative firms are attracted to areas that have high job densities, are located at the sea side and are county capitals, as it may be easier to exchange ideas and find large consumer markets prone to the concentration of creative workers and firms. Location of these firms is favoured by specialisation in manufacturing activities explained in terms of local related variety that benefits from inter-sectorial and transversal synergies (Lazzeretti et al. 2012). However, shares of SMEs do not help to attract new creative firms. Surprisingly, higher educational levels deter the location of new firms. Finally, local specialisation in creative activities strongly attracts creative firms, surely due to agglomeration economies emerging from these firms.

Finally, since the results for fashion firms show that only a few variables matter (i.e., job density, high-knowledge service employment and shore-line amenities), it can be assumed that location determinants rely on specific local characteristics not included in previous specifications. Moreover, the specialisation index in fashion industries has a positive and significant effect on the entry of fashion firms which indicates a strong dependence on localization economies around these activities.

A comparison of the results of the four estimations shows that traditional location determinants are quite similar for both creative and non-creative firms, but not for fashion firms. It is also found that both non-creative and creative firms are influenced by local specialisation in CIs, since they can benefit from higher levels of creativity that favour the emergence of new firms.

The results for metro and non-metro sub-samples vary slightly.[17] A technically qualified workforce encourages all firms and non-creative firms to locate in non-metro municipalities whereas a workforce from high-knowledge services and SICI only favour firm entry in metro municipalities. Higher levels of education deter creative firms from entering metro areas whereas jobs density and the percentage of industrial workforce only favour firm entry in metro areas. Moreover, geographical and institutional factors seem to affect only location decisions in metro areas. Finally, for fashion firms educational levels only influence entries in non-metro municipalities.

The estimations of bohemian location decisions can be found in Table 6. Generally speaking, more bohemians are found in densely populated areas with high incomes and a greater presence of young adults enrolled in college and gay couples. These results were foreseeable in view of the fact that municipalities with higher incomes should have a higher demand for goods and services in the arts, and areas with larger populations and higher concentrations of college students and gays provide an

[17] Although the differences between the two sub-samples do not appear to be large, the hypothesis of the equality of metro and non-metro coefficients is strongly rejected by a Chow test. This test is used to identify spatial patterns in the spatial econometrics literature (Anselin 1988).

environment prone to the exchange of ideas and alternative lifestyles, as well as the accessibility of cultural amenities. In both metro and non-metro areas, income levels, the number of gay couples and population density attract bohemians, which shows that they prefer to agglomerate in open-minded and cosmopolitan areas with good accessibility to cultural services. In contrast, metro and non-metro areas have different percentages of young people enrolled in college and foreigners. According to previous findings (Wojan et al. 2007a, 2007b; Mcgranahan et al. 2010), these differences among metro and non-metro areas may be largely explained by individual preferences and the creative sector in which they operate. Moreover, as Markusen and Johnson argue in their report (2006), lifecycle choices may also act as pull factors for young artists looking for training and access to arts and cultural infrastructures within cities, whilst experienced artists may be mostly attracted to rural areas due to lower cost of living, their different perception of quality of life and the fact that they do not need to locate near big markets if they have previously established their reputation in urban areas.

Table 6. Bohemian location decision (OLS)

Bohemians	(1) Total	(2) Metro	(3) Non_Metro
Art demand measures			
pcollege	4.659*	0.275	5.721**
	(2.714)	(5.755)	(2.794)
income	0.313***	0.442***	0.236***
	(0.063)	(0.116)	(0.0677)
Community amenities			
foreign	2.239	-1.237	3.558**
	(1.471)	(2.804)	(1.722)
gay_index	1.080***	1.045***	1.066***
	(0.058)	(0.077)	(0.104)
heritage	0.004	0.052	-0.012
	(0.037)	(0.076)	(0.043)
Settlement			
pop_density	0.064***	0.090***	0.042**
	(0.015)	(0.0277)	(0.016)
commuting	0.362	0.0491	0.551
	(0.312)	(0.463)	(0.421)
pop91a01	-0.033	-0.106	0.108
	(0.101)	(0.134)	(0.135)
Constant	-2.988***	-4.201***	-2.279***
	(0.518)	(0.906)	(0.550)
N	946	420	526
R^2	0.640	0.691	0.419
Log likelihood	-876.712	-446.392	-403.834
Mean VIF	1.31	1.1	1.16
Condition Number	2.39	2.84	2.03

Notes: *** p<0.01; ** p<0.05; * p<0.1.Robust standard errors in parentheses.

The validity of the bohemian model is confirmed by a specification test for omitted variables which failed to reject the assumption that the model is specified correctly.[18] Moreover, the explanatory power of the model is quite high (around 0.70). So the residual that proxies a *creative milieu* emerging from the bohemian model is subsequently examined more closely.

Table A.4. (see Appendix A) provides the results for *creative milieu*. The coefficient estimates do not differ substantially from the first model, so all the attention should be focused on this new parameter. The results show that an unobservable *creative milieu* has a positive impact on nearly all kinds of entries (all firms, non-creative and creative). This positive association can be confirmed for all firms and non-creative firms, and for creative firms only in the sample of all municipalities. The results demonstrate that traditional factors (i.e. agglomeration, accessibility, labour market, etc.) account for location decisions and other factors such as a creative atmosphere also play an important role (Wojan et al. 2007b; Musterd and Murie 2010; Murphy et al. 2014). Consequently, the hypothesis about the important role played by *creative milieu* in attracting firms is confirmed. This result supports the claim that an unobservable *creative milieu* – capturing the local identity, social and cultural interaction, *allure,* and other intangible components – has a great capacity to encourage entrepreneurship at municipality level. At the same time, but, these results suggest that the relevance of an unobservable *creative milieu* can only be strongly confirmed for all and non-creative firms, as their impact is significant for both metro and non-metro subsamples. Then, for CIs agglomeration economies partially seem to swamp effects arising from *creative milieu.*

[18] In order to check that the model is well specified a link test for model specification is applied. According to this test, a model is properly specified if no additional independent variables are significant except by chance. This test creates two new variables: the variable of prediction and the variable of the squared prediction. The model is correctly specified if the squared prediction is not significant (Tukey 1949).

Table 7. Location determinants of firms including spatial dependence (ZINBM)

Entries	(1) All firms	(2) Non_creative	(3) Creative	(4) Fashion
ptech	2.330**	2.347**	0.941	-6.778
	(1.070)	(1.080)	(3.131)	(5.452)
puni	-3.882***	-3.803***	-5.293***	-3.675
	(0.828)	(0.826)	(1.595)	(2.545)
job_den	0.113*	0.095	0.169**	0.254**
	(0.067)	(0.066)	(0.081)	(0.124)
job_pop	3.643***	3.430***	7.300**	8.658
	(0.957)	(0.960)	(3.243)	(5.849)
job_ser	0.106	0.074	-0.269	-1.319
	(0.271)	(0.272)	(0.749)	(1.273)
job_ind	0.516	0.448	0.328	0.550
	(0.637)	(0.640)	(1.498)	(2.553)
psmall	-0.967***	-0.967***	-0.509	-1.546*
	(0.223)	(0.223)	(0.509)	(0.856)
job_hk_ser	3.297***	3.268***	5.117***	6.617***
	(0.608)	(0.605)	(1.320)	(2.053)
sici [c]	0.154	0.109	0.673***	-
	(0.095)	(0.094)	(0.171)	
sici_fashion	-	-	-	0.309***
				(0.085)
creative_milieu	0.314***	0.308***	0.184*	0.256
	(0.060)	(0.06)	(0.106)	(0.174)
dist_cappro	-0.011***	-0.011***	-0.018***	-0.025**
	(0.002)	(0.002)	(0.006)	(0.012)
cap_com	1.237***	1.224***	1.143***	0.216
	(0.184)	(0.182)	(0.287)	(0.446)
seaside	0.636***	0.620***	0.517**	0.693*
	(0.150)	(0.149)	(0.262)	(0.390)
w_ptech	8.189	8.625	55.48**	132.0**
	(9.795)	(9.809)	(28.14)	(55.77)
w_puni	46.32***	44.08***	68.73*	4.629
	(15.77)	(15.74)	(38.55)	(63.44)
w_job_den	-0.300	-0.311	-0.672	-0.575
	(0.281)	(0.281)	(0.685)	(1.142)
w_job_pop	7.845	9.552	33.12	78.67
	(13.61)	(13.59)	(32.83)	(53.25)
w_job_ser	-6.797	-6.458	-22.45*	-2.948
	(5.266)	(5.259)	(12.45)	(21.44)
w_job_ind	2.409	2.187	-8.597	-29.61
	(7.251)	(7.253)	(17.25)	(28.44)
w_psmall	12.91**	12.82**	25.10**	-5.629
	(5.432)	(5.449)	(12.71)	(23.15)
w_job_hk_ser	3.810	3.918	23.13	-48.80
	(13.02)	(13.03)	(35.27)	(62.11)
w_sici	4.039***	4.046***	4.389	-
	(1.288)	(1.289)	(2.816)	
w_sici_fashion	-	-	-	2.090
				(1.746)
w_creative_milieu	0.274	-0.084	3.623	16.37**
	(1.885)	(1.888)	(3.766)	(6.970)
constant	-21.94**	-22.30**	-50.33**	-45.64
	(9.313)	(9.343)	(22.48)	(40.79)

Cont. Table 7. Location determinants of firms including spatial dependence (ZINBM)

Entries	(1) All firms	(2) Non_creative	(3) Creative	(4) Fashion
Inflated variables				
pop	-6.780***	-5.936***	-1.944***	-1.489**
	(1.146)	(1.052)	(0.630)	(0.593)
constant	1.870***	1.699***	2.780***	2.653***
	(0.325)	(0.310)	(0.605)	(0.775)
Vuong Test	6.02***	6.07***	4.24***	2.75***
N	946	946	946	946
Non zero observations	618	613	174	84
LR X^2	797.17	764.67	285.53	164.94
Log likelihood	-2195.586	-2168,249	-519.553	-284.168
AIC	4445.171	4390.498	1093.105	622.335
/lnalpha	-0.248***	-0.267***	-0.372**	0.260
	(0.073)	(0.076)	(0.186)	(0.271)
alpha	0.781	0.766	0.689	1.297
	(0.057)	(0.057)	(0.128)	(0.352)

Notes: *** p<0.01; ** p<0.05; * p<0.1. Standard errors in parentheses. [c] SICI excluding artists.

Finally, an enlarged location decision model to account for inter-municipal neighbouring externalities is estimated (see Table 7). Almost all the key location determinants remain significant as in previous estimations. However, adding spatial lagged variables reveals some interesting facts, one of which is that the differences between negative and positive signs of individuals with higher education measured at a municipality level or at a neighbouring municipalities level can be explained in terms of the wider geographical scope of labour markets (i.e., they go beyond municipality borders). A similar effect is found for the existence of SMEs, as the negative effect at the local level turns out to be positive at the extended spatial level (except for Fashion firms) which indicates that SME effects may extend beyond the boundaries of each municipality.

Lastly, the most important results are the effects of the *SICI* and *creative milieu* spatial spillovers. Whereas for non-creative firms and all firms the presence of specialised pools of creative workers in nearby municipalities has a positive and highly significant effect on the entry of new firms, creative and fashion firms seem to be only affected by specialisation in CIs at a local level. This has been pointed out by other scholars such as Cruz and Teixeira (2014a) and Wojan et al. (2007b) and reveals that the spatial scope of CIs externalities depends on the activity carried out. As far as the effect of a *creative milieu* is concerned, a creative atmosphere in nearby municipalities is found to only favour the entry of fashion firms. For all, non-creative and creative firms, however, it is only significant at local level. This result supports the previous finding in this chapter that intangible factors that identify a municipality play an important role in firms' location decisions, no matter what industry they belong to.

6. Conclusions

This article makes three main contributions to the literature on the location determinants of CIs (CIs): first, it analyses the location determinants of CIs from a wider territorial perspective (i.e., most of research in this area is limited to case studies) in order to get an overview of general location determinants; Second, it examines whether specialisation in CIs favours the location of all types of firm and find that it does; Third, it explores whether there is an unobserved *creative milieu* that favours the location of new firms and find that that there is and that it plays an important role in the location decisions of all kinds of firms (except for fashion ones), although much work still remains to be done on this point.

The econometric results show that the location determinants of creative and non-creative firms are quite similar and that both creative and non-creative firms are positively affected by worker specialisation in CIs. However, when spatial neighbouring externalities are taken into account this specialisation in CIs is found to have a limited spatial effect on the entry of creative and fashion firms, but a much greater one on the entry of non-creative and all firms. Moreover, results show that the same unobserved *creative milieu* that favours the existence of bohemians significantly influences firm entry, but its effect is more important for all and non-creative firms.

In terms of previous empirical contributions, on the one hand, these results are in line with Wojan et al. (2007b) findings and support the positive association between entrepreneurship and *creative milieu* claimed by Lee et al. (2004). On the other, they do not corroborate those contributions arguing that CIs are especially attracted to those intangible characteristics of municipalities (Scott 2006). In fact, the minor significance of an unobservable *creative milieu* on the location decision of CIs suggests that for these industries the role of agglomeration economies is even more important (Scott 1997). Indeed, the results of this chapter also support the association between the concentration of creative workers and new firms' creation at a municipality level (Scott 2000; Lee et al. 2004; Stam et al. 2008).

Still, these results have implications for policy. First, since it has been demonstrated that CIs play a positive role in attracting new firms, policies promoting firm entry should favour the spatial clustering of creative workers by encouraging the development of creative activities that a municipality has some tradition in (e.g. by supporting existing creative firms, assisting creative start-ups, strengthening creative business networks and marketing the city's image). And secondly, local authorities pursuing a diversified economic strategy should encourage social and cultural interaction that can lead to a particular *creative milieu* that can give them comparative advantages once traditional location factors have been satisfied. Still, bearing in mind that in the near future about 70% of

population will be concentrated in large cities, such policies should adapt to metro and non-metro municipalities characteristics. In this sense, for non-metro municipalities these strategies should focus on preserving and emphasizing those factors defining their quality of life, whilst for metro municipalities strategies should be directed towards the creation and development of facilities increasing probabilities of accessibility to networking and cultural experiences.

Despite all this, this chapter does have some limitations. In this regard, any future research should focus on analysing the location behaviour of specific CIs, not groups of them, given that our overall results may not reveal some heterogeneities due to the locational specificities of the creative activities in our data set. The approach to a *creative milieu* effect could be susceptible to omitted variables critiques, where *creative milieu* is reduced to a misspecification error. For this reason the way in which an unobservable *creative milieu* is measured should be refined. Moreover, using more disaggregated data would allow discriminating between 'pure-creative' and 'semi-creative' activities and reduce the potential bias of the results.

Appendix A

Table A.1. Correlation of independent variables of firm entries model

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. ptech	1													
2. puni	0.0724*	1												
3. job_den	0.0253	0.0051	1											
4. job_pop	0.0382	0.1391*	0.0694*	1										
5. job_ser	0.0163	0.1886*	0.0916*	0.0210	1									
6. job_ind	0.0991*	-0.2191*	0.1274*	0.2456*	-0.3728*	1								
7. psmall	-0.0296	0.0716*	-0.1929*	-0.2588*	0.2747*	-0.3995*	1							
8. job_hk_ser	-0.0498	0.1539*	0.2483*	0.0637	0.2640*	-0.0084	-0.0993*	1						
9. sici	-0.0343	-0.0078	0.1771*	0.1468*	-0.1681*	0.4521*	-0.2031*	0.0870*	1					
10. sici_fashion	-0.0427	-0.1361*	0.0307	0.0311	-0.2159*	0.3857*	-0.1053*	-0.0231	0.8441*	1				
11. creative_milieu	0.0065	0.0777*	-0.0078	-0.0123	0.0013	0.0892*	-0.1603*	0.0940*	0.0897*	0.0552	1			
12. dist_pro	-0.0071	0.0014	-0.2104*	-0.0605	0.0903*	-0.1939*	0.1351*	-0.1341*	-0.1462*	-0.0576	-0.0127	1		
13. cap_com	-0.0201	0.0529	0.1473*	0.0518	0.1054*	0.0278	-0.1255*	0.2949*	0.0864*	0.0397	0.1217*	0.0021	1	
14. seaside	-0.1053*	0.0358	0.2184*	-0.0081	0.1470*	-0.1615*	-0.0604	0.1901*	-0.0132	-0.0492	0.0974*	-0.1017*	0.0588	1

Notes: * Significance at 5%.

T**able A.2.** Correlation of independent variables of bohemian's model

	1	2	3	4	5	6	7	8
1. pcollege	1							
2. income	0.0908*	1						
3. foreign	-0.0065	-0.2153*	1					
4. gay_index	0.1084*	0.3171*	0.1327*	1				
5. heritage	-0.0793*	0.2585*	0.2230*	-0.0014	1			
6. pop_density	0.0044	0.3348*	0.1233*	0.4889*	0.0486	1		
7. commuting	0.0634	0.3238*	0.0409	0.2237*	-0.0885*	0.3322*	1	
9. pop91-01	-0.0304	0.4653*	0.2516*	0.1410*	0.0495	0.1529*	0.2716*	1

Notes: * Significance at 5%.

Table A.3. Spatial autocorrelation tests

	Bohemians model	Firm entries model
Moran's I	1.29	0.00
p-value	(0.196)	(0.997)
Spatial error	2.30	0.473
p-value	(0.129)	(0.492)
Spatial Lag	1.82	1.63
p-value	(0.032)	(0.202)

Table A.4. Location determinants of firms with '*creative milieu*' effect (ZINBM)

	All firms			Non-creative			Creative			Fashion		
Firm Entries	(1) Total	(2) Metro	(3) Non_Metro	(1) Total	(2) Metro	(3) Non_Metro	(1) Total	(2) Metro	(3) Non_Metro	(1) Total	(2) Metro	(3) Non_Metro
ptech	3.668***	0.154	5.199***	3.753***	0.0600	5.320***	2.970	1.118	-1.462	-2.706	-3.716	-20.87**
	(1.079)	(1.998)	(1.327)	(1.087)	(2.010)	(1.328)	(2.850)	(4.328)	(4.524)	(4.990)	(7.431)	(9.551)
puni	-1.283	-1.716	-1.973	-1.189	-1.559	-1.933	-2.602	-3.507*	2.973	0.406	0.406	18.60***
	(0.837)	(1.081)	(1.452)	(0.834)	(1.064)	(1.456)	(1.595)	(1.837)	(3.974)	(2.556)	(2.866)	(6.782)
job_den	0.367***	0.257***	1.771***	0.349***	0.240***	1.747***	0.336***	0.240***	0.312	0.419***	0.415***	-0.201
	(0.081)	(0.077)	(0.481)	(0.0794)	(0.0742)	(0.472)	(0.086)	(0.086)	(0.433)	(0.132)	(0.127)	(0.477)
job_pop	5.155***	2.949**	7.865***	4.903***	2.642**	7.680***	10.35***	7.749*	11.30**	10.16*	3.455	5.095
	(0.944)	(1.230)	(1.520)	(0.945)	(1.223)	(1.523)	(3.166)	(4.070)	(4.748)	(5.742)	(7.995)	(8.569)
job_ser	0.640**	0.654	0.175	0.604**	0.579	0.138	0.240	-0.411	0.957	-0.982	-2.772	3.397
	(0.285)	(0.491)	(0.335)	(0.286)	(0.491)	(0.335)	(0.781)	(1.054)	(1.135)	(1.315)	(1.739)	(2.565)
job_ind	3.760***	5.392***	1.774**	3.738***	5.373***	1.714**	3.685***	4.769**	2.936	3.428	4.197	3.890
	(0.576)	(0.973)	(0.699)	(0.575)	(0.961)	(0.698)	(1.301)	(1.877)	(1.889)	(2.208)	(3.302)	(3.297)
psmall	-1.131***	-0.970***	-0.859***	-1.126***	-1.026***	-0.863***	-0.473	-0.522	0.389	-1.006	-1.005	-2.300
	(0.240)	(0.363)	(0.303)	(0.239)	(0.359)	(0.302)	(0.528)	(0.680)	(0.848)	(0.887)	(1.142)	(1.545)
job_hk_ser	3.382***	4.821***	1.240	3.322***	4.747***	1.205	5.952***	6.569***	4.421*	7.642***	8.228***	3.145
	(0.684)	(0.984)	(0.819)	(0.679)	(0.968)	(0.812)	(1.426)	(1.756)	(2.546)	(2.250)	(2.857)	(3.840)

Table A.4. Continued (i)

	All firms			Non-creative			Creative			Fashion		
Firm Entries	(1) Total	(2) Metro	(3) Non_Metro	(1) Total	(2) Metro	(3) Non_Metro	(1) Total	(2) Metro	(3) Non_Metro	(1) Total	(2) Metro	(3) Non_Metro
sici [b]	0.320***	0.297*	0.085	0.267**	0.214	0.0322	0.801***	1.160***	0.675***	-	-	-
	(0.112)	(0.168)	(0.127)	(0.112)	(0.163)	(0.127)	(0.189)	(0.295)	(0.192)			
sici_fashion	-	-	-	-	-	-	-	-	-	0.406***	0.565***	0.409***
										(0.092)	(0.163)	(0.078)
creative_milieu	0.349***	0.310***	0.420***	0.343***	0.294***	0.432***	0.200*	0.192	-0.054	0.239	0.267	-0.157
	(0.063)	(0.081)	(0.098)	(0.0626)	(0.0802)	(0.0978)	(0.111)	(0.134)	(0.185)	(0.175)	(0.209)	(0.297)
dist_cappro	-0.010***	-0.008	-0.009***	-0.0104***	-0.00739	-0.00894***	-0.013***	-0.0193**	-0.008	-0.011	0.008	-0.019
	(0.002)	(0.005)	(0.00256)	(0.00183)	(0.00453)	(0.00256)	(0.005)	(0.009)	(0.007)	(0.008)	(0.016)	(0.015)
cap_com	0.741***	0.498	1.023***	0.726***	0.499*	1.002***	0.544**	0.452	0.677	-0.181	-0.245	-0.526
	(0.193)	(0.305)	(0.240)	(0.190)	(0.297)	(0.238)	(0.273)	(0.360)	(0.433)	(0.441)	(0.547)	(0.803)
seaside	0.658***	0.633***	0.672***	0.634***	0.601***	0.655***	0.694***	0.844***	0.255	1.061***	0.831**	-0.826
	(0.148)	(0.191)	(0.234)	(0.147)	(0.187)	(0.233)	(0.243)	(0.277)	(0.586)	(0.369)	(0.415)	(1.145)
constant	-1.337**	-0.244	-2.357***	-1.216**	0.0116	-2.271***	-6.800***	-5.162**	-8.141***	-6.633**	-3.035	-4.522
	(0.542)	(0.820)	(0.790)	(0.542)	(0.808)	(0.790)	(1.700)	(2.352)	(2.602)	(2.780)	(3.910)	(3.875)

Table A.4. Continued (ii)

	All firms			Non-creative			Creative			Fashion		
Firm Entries	(1) Total	(2) Metro	(3) Non_Metro	(1) Total	(2) Metro	(3) Non_Metro	(1) Total	(2) Metro	(3) Non_Metro	(1) Total	(2) Metro	(3) Non_Metro
Inflated variables												
pop	-6.342***	-7.396***	-6.008***	-5.322***	-4.856***	-5.815***	-1.706***	-0.704***	-3.296***	-1.462**	-0.328***	-4.023***
	(1.141)	(2.174)	(1.439)	(0.992)	(1.158)	(1.398)	(0.516)	(0.263)	(0.908)	(0.583)	(0.116)	(1.511)
constant	1.734***	2.425***	1.454***	1.528***	1.824***	1.415***	2.790***	1.782***	4.429***	2.794***	1.863***	6.502***
	(0.324)	(0.638)	(0.396)	(0.301)	(0.443)	(0.389)	(0.551)	(0.515)	(0.938)	(0.760)	(0.495)	(1.987)
Vuong Test	5.95***	5.11***	3.85***	6.06***	5.32***	3.85***	5.02***	3.40***	3.65***	3.40***	2.45***	1.82**
N	946	420	526	946	420	526	946	420	526	946	420	526
Non zero obs.	618	319	299	613	315	298	174	122	52	84	62	22
LR X^2	674.68	330.73	261.68	643.48	314.37	254.57	243.03	163.39	63.98	131.44	87.08	63.53
Log likelihood	-2256.829	-1242.962	-981.152	-2228.846	-1224.521	-969.773	-540.805	-376.344	-151.473	-300.917	-218.895	-59.543
AIC	4547.658	2519.923	1996.305	4491.692	2483.043	1973.546	1115.611	786.689	336.946	635.834	471.790	153.087
/lnalpha	-0.032	-0.123	-0.157	-0.059	-0.183**	-0.174	-0.058	-0.255	-0.865	0.679***	0.189	-15.37
	(0.069)	(0.089)	(0.117)	(0.072)	(0.0923)	(0.119)	(0.168)	(0.206)	(0.552)	(0.231)	(0.331)	(842.7)
alpha	0.969	0.884	0.855	0.943	0.832	0.839	0.943	0.775	0.421	1.971	1.207	0.000
	(0.067)	(0.079)	(0.100)	(0.067)	(0.077)	(0.099)	(0.158)	(0.160)	(0.232)	(0.454)	(0.399)	(0.000)

Notes: Robust Standard errors in parentheses. [b] SICI excluding artists. *** p<0.01; ** p<0.05 ; * p<0.1.

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Chapter 3

Creative industries and firm creation: Disentangling causal effects through historical cultural associations

1. Introduction

The creative industries (CIs), defined as a set of economic activities that use creativity as the main input and which provide tangible or intangible goods or services with creative content and economic value potentially generating revenues from trade and intellectual property rights (UNCTAD 2010), have been shown to have considerable potential in terms of local economic growth, development and competitiveness (see, for instance, Florida 2002a; European Commission 2010; UNCTAD 2008, 2010). In an increasingly global world, those sectors incorporating high value added from creativity and knowledge – i.e. the CIs – play a key role in the transformation of economic activity (Sassen 2009). Because of this, local governments have attempted to attract CIs to their cities to improve their regional competitiveness.

CIs are positively associated with economic growth because creativity is a source of innovation and industrial mix reconfiguration process (Hall 2000; Florida 2002a; Scott 2004; Currid and Connolly 2008; UNCTAD 2010; Potts 2011). Lee (2014) tries to identify this causal relationship by summarising the three mechanisms by which CIs can lead to economic growth according to the literature. First, CIs are attractive simply as a growth sector, and their multiplier effect increases local demand. Second, CIs can increase productivity in other sectors. Third, CIs can have an amenity value because they attract skilled residents or tourists. So, in line with Chapter 2, municipalities with higher levels of employment in CIs should be more able to attract new firms because of knowledge spillovers in terms of creativity and innovation, leading to new business development and growth in other industries (Scott 2000; Lee et al. 2004; De Jong et al. 2007; Stam et al. 2008).

Although much of the research done suggests that CIs enhance economic outcomes, there is still some debate about the potential effect of reverse causality on these models, as CIs may also be attracted to already successful areas (Hall 2000; Markusen 2006, 2010). The Ordinary Least Squares (OLS) estimation of the effect of CIs on economic dynamism may lead to inconsistent estimation of the coefficients since it assumes that regressors are uncorrelated with the errors. Moreover,

omitted variable biases (i.e., quality of public infrastructures and cultural amenities) can also contribute to the inconsistency of the estimation. Thus, the instrumental variables (IV) technique is the leading approach to address both issues as it allows to identify and isolate any source of potential endogeneity. In this regard, Lee (2014) made the first attempt to deal with this causal relationship by using IV. However, his results are still inconclusive and it seems that more theoretical and empirical studies are required.

Besides the traditional location factors that encourage the concentration of creative employment – i.e., agglomeration economies within the organization of industry; the existence of historical and cultural infrastructures; the infrastructure of specialised public and social actors that provide support for these activities; and 'soft factors' [19] or amenities in terms of quality of life, tolerance, and cosmopolitan environments – a particular identity also attracts creative talents in line with Chapter 2 of this thesis (Scott 2000; Andersson and Andersson 2008; Pareja-Eastaway et al. 2008; Murphy et al. 2014). This particular identity, as an intangible characteristic, is difficult to measure and only a few papers have tried to disentangle its effects on economic dynamism. Chapter 2 of this thesis and Wojan et al. (2007b) try to identify an unobservable *creative milieu* (as a proxy measuring the image of a specific location that helps to attract creative talents and entrepreneurs) and use a two-step procedure to examine if this unobservable *creative milieu* attracts businesses and artists to a particular municipality. However, their approach may be susceptible to omitted variables critiques, which reduce *creative milieu* to a misspecification error. Thus, this chapter presents an alternative approach to deal with this issue.

In this regard, it should be taken into account that despite the potential of CIs for enhancing the location of economic activity, the conditions for creating or stimulating creative knowledge regions in a context of a globalised economy are certainly dependent on urban history and the economic tradition of the territory (Pareja-Eastaway and Pradel-i-Miquel 2014). This urban history can be controlled to some extent and the tolerant, creative, proactive and venturesome personality of a municipality can be captured through cultural organizations or associations as the emergence of city institutions protecting economic and political freedoms facilitates the attraction and production of creative talent (Serafinelli and Tabellini 2017). Cultural associations (or *ateneus* in Catalan) are private institutions that aim to educate, cooperate and disseminate modern science and culture among its members and population (Arnabat and Ferré 2015). They arose in Catalonia in response to popular

[19] Soft characteristics are understood as 'specific urban amenities that create an environment that attracts people who are key to the most promising economic activities for the economic development of the urban region' (Musterd and Murie 2010). The term 'soft' is used because these factors are difficult to measure or define (Clark et al. 2002).

demand to bring cultural, social, economic and political changes in the last third of the nineteenth century.

Therefore, this chapter presents an alternative approach to that of Chapter 2 of this thesis, Wojan et al. (2007b) and Lee (2014). It attempts to fill the gaps in these studies by analysing the links between CIs – defined as those industries that provide employment in arts, advertising, architecture, design, audio-visual, publishing, software, videogames, and radio and television – and new firm location for Catalan municipalities between 2002 and 2007. In particular, it investigates two questions: 1) Do cultural associations capturing the unobservable local identity of a municipality explain the present concentration of creative employment? And 2) Do CIs lead to new firm location?

Because of the potential endogeneity of employment in CIs, this chapter relies on cultural associations and urban population in the eighteenth and nineteenth centuries as sources of exogenous variation. Cultural associations democratised culture and knowledge in all its fields. Since these cultural associations were not randomly located and some of the local factors influencing the foundation of cultural associations in the nineteenth and twentieth centuries may still influence the present concentration of creative employment in these municipalities, instrument exogeneity and relevance should be satisfied. The main statistical source is the REIC (Catalan Manufacturing Establishments Register), which has plant-level microdata on the location of new plants in Catalan municipalities between 2002 and 2007. By making use of these historical IVs, results confirm the potential of CIs for new firm creation. In particular, results show that by increasing employment in creative service industries (CSIs) by 10%, the number of new firms located in the municipality increases by 6.7%. These results are robust across metropolitan and non-metropolitan municipalities, and also across different empirical approaches. They support the view that CIs lead to economic dynamism (i.e., new firm creation) in the local economy. Furthermore, the IV results suggests that the intrinsic and historical identity defining the municipality – in terms of cultural associations – explains why creative employment is attracted to the municipality and, at the same time, this encourages the location of new firms.

The remainder of the chapter is as follows. Section 2 outlines the links between cultural associations and creativity. Section 3 presents the methods used. Section 4 presents the data and Section 5 discusses the main results. Finally, Section 6 summarises main conclusions and the implications for policy makers.

2. Cultural associations: a source of creativity

2.1. Defining cultural associations

When it comes to explaining the relevance of *associacionisme* [20] in Catalonia, first it is important to understand what cultural associations (or *ateneus* in Catalan) are. According to the Gran Enciclopèdia Catalana (1968), a cultural association can be defined as a literary and scientific association that aims to increase the intellectual level of its members by holding seminars, conferences, courses and readings. Furthermore, a cultural association is defined as an institution that creates and accepts culture, and which disseminates and contrasts different cultural alternatives resulting from human reason, which may be scientific or literary (Solà 1978). The general term "cultural associations" refers to different types of cultural or leisure entity. To a large extent, the name of the entity indicates the ideology underlying its foundation (Arnabat and Ferré 2015).

2.2. The history of cultural associations in Catalonia

Cultural associations were at their most effervescent time in the second third of the nineteenth century in the framework of a liberal Catalonia that was being industrialised, but which generated considerable social and cultural inequalities. They arose from the working classes in order to compensate for the lack of public investment in education and culture. Throughout the first third of the twentieth century, they became more established and were soon a key part of Catalan civil society and its associative network (*associacionisme*) (Arnabat and Ferré 2015; Navais 2017). Years later, the Franco dictatorship banned most cultural associations, although they never really stopped working during these troubled political times (Santacana 2013).

In Europe, cultural associations had their origin in the scientific-literary societies founded in the eighteenth century. Broadly speaking, these institutions were designed for the privileged classes and disseminated culture among its associates. This model was extended to Spain in the nineteenth century (Villacorta 2003). Unlike the rest of Europe, in Catalonia the fact that the Spanish State did not cover basic needs such as health, culture and education gave cultural associations the double function of socializing and educating the less-favoured classes. They were also characterized by their ability to promote social cohesion and popular culture (Bosch 1991; Todó-i-Tejero 2000).

2.3. From cultural associations to creativity

[20] *Associacionisme* (associationism) can be defined as a social, legal and historical phenomenon in modern societies consisting of the will of several individuals to set up associations to achieve predetermined goals or to satisfy specific interests (Mestre-i-Campi 1998). Also Bermeo and Nord (2000) understand associationism as a means of self-organisation within civil society in a Western-style society. Please do not confuse *associacionisme (*the Catalan term*)* with associationism (i.e. the psychological and philosophical theory).

At this point the reader may be wondering how cultural associations are related to creativity and, particularly, to creative employment. In the words of the former Minister of Culture of the Catalan Government F. Mascarell, creativity has an individual origin, but it cannot be forgotten that the most important fact about creativity is its transmission (Arnabat and Ferré 2015). The role of cultural associations in this transmission needs to be understood.

The basic ideas underlying cultural associations were freedom of speech and tolerance since they were the only source of entry and dissemination of new ideas. In most cases, artists and other creative minds found that cultural associations gave them a meeting point to discuss their ideas and the support to develop their projects (Navais 2017). At the same time, cultural associations were the only way by which the working classes could access cultural activities, especially, in the less populated municipalities (Baltà 1999; Arnabat and Ferré 2015). Indeed, cultural associations released many working-class Catalans from illiteracy, particularly in those municipalities with lower illiteracy rates, usually rural areas (Solà 1998; Arnabat and Ferré 2015). In this regard, the connection between cultural associations and the cultural development and literacy of society is undeniable. Consequently, cultural associations became an essential cultural and social structure for municipalities, giving them a collective identity and their citizens a sense of connection and belonging (Fontana 2014; Navais 2017).

As it has been said above, a municipality's ability to attract and retain creative individuals essentially depends on urban history and the "soft factors" in terms of city environment that shape the particular identity of the municipality (Landry 2000; Florida 2002a; Scott 2006). In fact, this particular identity of the municipality is path dependent. Thus, cultural associations – through the influence of the local bourgeoisie and working classes[21] – developed the cultural synergies and personality of municipalities and, therefore, determined their subsequent ability to enhance the emergence of CIs years later (Pareja-Eastaway and Pradel-i-Miquel 2014; Serafinelli and Tabellini 2017). Indeed, the role of cultural associations and cultural path-dependency on the present development of creative cities has been pointed out in recent studies by García-García et al. (2012), Andres and Chapain (2013), Ponzini et al. (2014) and Bonfanti et al. (2015).

All in all, given the reasons that led to the development of cultural associations in the late eighteenth and early twentieth centuries, this article considers that the foundation of a cultural association in a municipality reveals the extent of its cultural sensitiveness, tolerance to new ideas

[21] In most cases the support of the local bourgeoisie assured the survival and expansion of cultural associations. The working class also promoted their own cultural institutions and associations, mainly based on anarchist and republican ideas through culture that brought dynamism to their cities (Keating 2001; Pareja-Eastaway and Pradel-i-Miquel 2014; Navais 2017).

and proactivity. In particular, if the creation of cultural associations in the eighteenth and early twentieth centuries provided some of the most important factors that still today explain the location of creative individuals (i.e., a shared cultural identity, proactive attitude); these municipalities must now have some advantage in attracting to them population employed in CIs. In short, this article argues that some of the local factors arising from the foundation of cultural associations in the nineteenth and twentieth centuries may still influence the present concentration of creative employment in these municipalities.

2.4. Stylised facts on cultural associations

In the nineteenth and twentieth centuries 2,170 cultural associations were set up in Catalonia (see Table 1). Most of these cultural associations have their origin in the nineteenth century (708) and the first third of the twentieth century (985) because the first Spanish constitution allowed freedom to associate (Olías-de-Lima 1977). The instability of the Civil War obviously had an effect and only 45 new cultural associations were founded in this period. In the subsequent dictatorship there were very few new cultural associations (287), and most of those that were founded associated with the Franco regime (Augé 2004). However, contrary to what might be thought, this decreasing trend persisted once democracy had been established. More specifically, only 159 new cultural associations were founded between 1975 and 2014. In this regard, the socio-economic changes of the late twentieth century have contributed to the decline of cultural associations and their subsequent appropriation by the market (Baltà 1999).

Table 1. Creation of cultural associations by historical periods

Time Period	Historical period	Cultural associations
1800 - 1900	Industrialisation	708
1900 - 1935	Restauration	985
1936 - 1939	Civil War	45
1940 - 1975	Dictatorship	287
1975 - 2014	Democracy	159
1800 - 2014	-	2,170

Source: Own elaboration on Arnabat and Ferré (2015)'s data

As far as the geographical distribution of cultural associations in Catalonia in the nineteenth and twentieth centuries is concerned, Barcelona (306), Vilanova i la Geltrú (45) and Valls (34) stand out as the municipalities where most new centres were created (see Table 2). Although all these municipalities are local capitals, most of them are not among the most populated and dynamic in terms of firm entries, except for Barcelona as capital of the region. Nevertheless, it seems that those municipalities with most cultural associations are also among the ones with the highest number of

employees in CIs nowadays, which upholds the idea that they may have provided some of the factors that still influence the concentration of creative employment.

Table 2. The 10th municipalities with a higher number of cultural associations

#	Municipality	Cultural Associations (1800-2014)	Firm entries (2002-2007)	Employment in CIs (2001)
1	Barcelona	306	810	61,401
2	Vilanova i la Geltrú	45	71	485
3	Terrassa	34	396	1,952
4	Valls	34	46	237
5	Lleida	33	152	1,633
6	Sabadell	32	253	2,529
7	Vilafranca del Penedès	31	40	412
8	Mataró	28	341	1,088
9	Manresa	27	92	868
10	Banyoles	27	30	142

Source: Own elaboration with Arnabat and Ferré (2015), IDESCAT, and REIC's data.

Seen in terms of population (Table 3), municipalities with the highest indices of new cultural associations per inhabitant are Olèrdola (0.0097), Puigdàlber (0.009) and Guardiola de Berguedà (0.0066) among others. Although these municipalities are mainly located in the interior of the province of Barcelona where levels of population and economic dynamism are low, they are characterised by artistic, cultural and social inquisitiveness.

Table 3. The 10th municipalities with more cultural associations per inhabitant (1900)

#	Municipality	# Cultural As. (1900-1935)	Population (1900)	Cultural As./inhabitant (1900)
1	Olèrdola	14	1,436	0.0097
2	Puigdàlber	4	442	0.0090
3	Sant Llorenç d'Hortons	7	924	0.0076
4	Vilanant	4	539	0.0074
5	Guardiola de Berguedà	2	303	0.0066
6	Banyeres del Penedès	5	776	0.0064
7	Copons	5	777	0.0064
8	els Guiamets	2	412	0.0049
9	Pacs del Penedès	2	416	0.0048
10	Biosca	4	846	0.0047

Source: Own elaboration with Arnabat and Ferré (2015), Census 1900 and 2001 (INE), and REIC's data.

This chapter mainly focuses on the setting up of cultural associations (*ateneus)* during the most representative period in the history of cultural associations in Catalonia: that is, the nineteenth century (1800-1899) and the first third of the twentieth (from 1900 to 1935). Their relevance and exogeneity as IVs to instrument the effect of the employment in CIs on firm entries are discussed

in-depth in Section 5.2. Here the spatial patterns and stylised facts for these variables are presented as well as the distribution of population in 1900 for all the municipalities of Catalonia.

Figure 1 depicts the spatial patterns of these historical IVs. According to Panel A, even if in most Catalan municipalities no cultural associations were created in the nineteenth century, the spatial distribution of cultural associations was not homogenous throughout Catalonia. This geographical pattern holds for the creation of cultural associations between 1900 and 1935 (Panel B). In this case, however, the number of municipalities with at least one cultural association is even larger and they are spread more widely throughout the region. In this regard, cultural associations were created in both inland and seaside municipalities. A comparison of these geographical patterns with the spatial distribution of the population in 1900 (Panel C) confirms the idea that even in the least industrialised and populated municipalities an important cultural and social movement was emerging.

Alternative IVs were considered for this study, although they are difficult to obtain or their relevance and exogeneity may be controversial. Some examples of this are:

1) The artistic and cultural heritage destroyed by political conflicts and then rebuilt by civil society with funding from the local bourgeoisie. Although this should be a remarkable IV, this data is not easy to find and its exogeneity may be controversial as it could be correlated with unobserved variables (i.e., local availability of capital for CIs).

2) The exodus of artists from Catalan municipalities due to the Spanish Civil War and the subsequent repression and moral censorship by the Franco regime (Santacana 2013; Hellmanzik 2016),[22] as it may be thought that the municipalities from which most artists and intellectuals emigrated should be more creative and culturally sensitive. Yet, this is not easy to justify, since municipalities with a greater exodus of artists may have had a greater concentration of artists because they were important cities where cultural and intellectual infrastructures were more plentiful and the market was larger. Likewise it would be far from easy to identify this data.

3) The number of cultural associations per municipality during the Franco regime. Although this may be a good example of local initiative and cultural inquisitiveness, the fact that very few cultural associations survived and that most of the new cultural associations created during this period were associated with the Franco regime may make their relevance debatable (Augé 2004; Pareja-Eastaway and Pradel-i-Miquel 2014; Navais 2017).

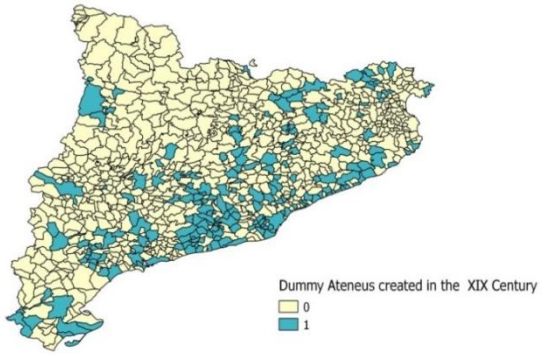
4) The density of cultural associations per inhabitant or per km^2, but this is highly correlated with contemporaneous population density which may bring their exogeneity into question.

[22] Hellmanzik (2016) presents evidence of peer effects in creative production using an IV estimation based on the exodus of artists from Paris due to the Second World War.

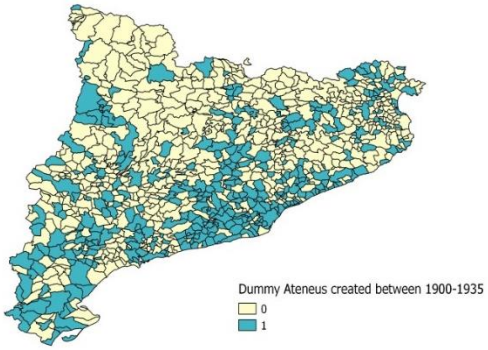
Bearing in mind all the above, the two dummy variables indicating the setting up of cultural associations in the nineteenth century (1800-1899) and in the first third of the twentieth (from 1900 to 1935) are hypothesised to be the best options for dealing with the possible reverse causality between employment in CIs and firm entries.

Figure 1. Spatial distribution of cultural associations (*Ateneus*) and historic population

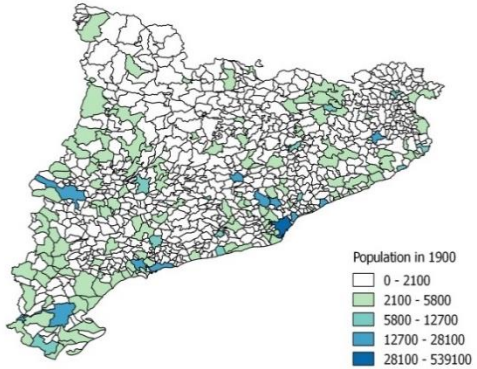
Panel A. *Municipalities with cultural associations created in the nineteenth Century*



Panel B. *Municipalities with cultural associations created between 1900 - 1935*



Panel C. *Spatial distribution of population in 1900*



Source: Own elaboration using Arnabat and Ferré (2015), and Census 1900 (INE).

3. Methods

3.1. Model specification

In order to test the relationship between CIs and new firm creation in metro and non-metro municipalities in Catalonia, the number of new and relocated manufacturing establishments over 2002 and 2007 (*Firm entries*) in a municipality is estimated as a function of employment in CSIs (*CSI)* and a set of specific local characteristics:

$$Firm\ entries_{i(2002-2007)} = \beta_0 + \beta_1 CSI_{i(2001)} + \beta_2 puni_{i(2001)} + \beta_3 ptech_{i(2001)} + \beta_4 pop\_density_{i(2001)} + \beta_5 job\_pop_{i(2001)} + \beta_6 income_{i(2001)} + \beta_7 job\_ind_{i(2001)} + \beta_8 psmall_{i(2001)} + \beta_9 dist\_pro_i + \beta_{10} altitude_i + \beta_{11} seaside_i + u_i \quad (1)$$

3.1.1. Explaining firm entries

According to the literature on firm location decisions, education in terms of technical and graduate studies (*ptech*, *puni*) is an important location factor whatever characteristics a firm may have. However, commuting flows may solve spatial mismatch in the labour market if there are appropriate transport infrastructures (Arauzo-Carod 2005). There is wide consensus on the more productive environment (which is preferred by firms) generated by agglomeration economies (*pop_densisty*, *job_pop*). Higher income levels should encourage the creation of firms by facilitating access to possible additional financial support at the time of running a new business (*income*). The industrial mix (*job_ind*) helps to capture the local economic structure. Similarly, the existence of a wide range of small firms (*psmall)* typically encourages firms to locate, as suggested by the Incubator Hypothesis (Garofoli 1994). Obviously, geography and institutional issues matter (Guimarães et al. 2000), as firms need good accessibility to services provided in cores, so it is necessary to control for the geographical position of the municipalities (*seaside, altitude*) and their distance from main cities (*dist_pro*) because of their institutional importance. Finally, municipalities with most employment in CSIs (*CSI*) should favour the entry of all kinds of firm. The results for this explanatory variable allow us to test the main hypothesis of this chapter.

Although some authors argue that adding human capital and creative class to the model could give endogeneity problems (Glaeser 2004; Markusen 2006, 2010), this chapter avoids this issue as it relies on employment in CIs (defined by UNCTAD) and not on the concept of creative class (which defines as creative those occupations requiring high levels of education). In fact, *CSIs* attempts to capture the concentration of employment (with different levels of human capital) in those sectors in which creativity is very important to their activity.

3.2. Model selection

Under the assumption that the random element of the number of firm entries is uncorrelated with employment in CSIs, Eq. (1) can be estimated by ordinary least squares (OLS). However, as Hall (2000) and Markusen (2006, 2010) point out, CIs may not be randomly located. On the contrary, their location is expected to be endogenous to economic dynamism: CIs may also be attracted to the most successful municipalities, thus leading to reverse causality. In an attempt to deal with this issue, this chapter implements an IV strategy which uses the historical instruments discussed in Section 2.

Another concern about the above approach is that estimating the number of firm entries by using OLS may lead to a coefficient bias since the number of firm entries could be understood to be a discrete response variable. For econometric estimation, Count Data Models have commonly been used to deal with this location phenomenon from a spatial point of view: i.e., when trying to explain how the local characteristics of different sites (e.g., municipalities, counties or regions) can influence firm decisions (see Arauzo-Carod et al. 2010, for a review of the empirical literature). Poisson models seem to be the starting point, but they have some limitations. They assume that the mean and variance are equal, but this is not usually the case when dealing with location decisions because of the concentration of entries in some areas, which involves an overdispersion problem. This problem can be solved by the generalised form of the Poisson model (the Negative binomial model), which introduces an individual unobserved effect into the conditional mean and allows the variance to exceed the mean.

Nevertheless, the use of CDM raises the issue of reverse causality again. Cameron and Trivedi (2010) propose a structural-model approach to control for endogeneity when estimating CDM. More specifically, this chapter applies a bootstrap for Poisson and Negative binomial two-step estimations (see Cameron and Trivedi 2010, pp. 592-595 for further details).

4. Data

The data in this chapter are from Catalonia,[23] an autonomous region in north-eastern Spain whose capital is Barcelona. The data includes one dataset about the location of new plants (dependent variable) and another dataset about territorial characteristics (independent variables). The dataset about the location of new plants is the Register of Manufacturing Establishments of Catalonia (REIC), supplied by the Catalan Government (Ministry of Innovation, Universities and Enterprise), which has plant-level microdata on the location of new and relocated manufacturing plants.[24] This

[23] Catalonia has about 7.5 million inhabitants (15% of Spain's population) and a surface area of 31,895 km^2. It accounts for 19% of the Spanish GDP.

[24] See Manjón-Antolín and Arauzo-Carod (2011) for a detailed analysis of the interrelations between locations and relocations using the same dataset. Their results show that the location patterns of both new and relocated firms are quite similar.

dataset includes 10,033 manufacturing plants with codes 011 to 930 that located in Catalonia between 2002 and 2007.

To define CIs, this chapter follows UNCTAD's proposal (2010) as it is the most widely accepted by researchers (see Boix-Domenech and Lazzeretti (2012), among others). UNCTAD's classification includes a wider range of industries from both the manufacturing and service industries. Even so, creative service firms are more important than manufacturing ones. In this chapter only CSIs are considered as Boix-Domenech and Soler-Marco (2017) suggested further research should focus exclusively on CSIs because creativity is more evident in creative services than in creative manufacturing.

Accordingly, this chapter works with 13 creative service sectors with codes between 221 and 925 (see NACE-93 industry classifications in Table 4). Applying this criterion, the Census dataset reports 111,380 employed in CSIs.

Table 4. Creative Service Industries Employment (by NACE-93 classification)

Code	Creative Service Industries (CNAE 93.1)	Employment (2001)
221	Publishing	14,151
223	Reproduction of recorded media	78
721	Hardware consultancy	27,049
722	Software consultancy and supply	4,241
731	Research and experimental development on natural sciences and engineering	1,155
732	Research and experimental development on social sciences and humanities	165
742	Architectural and engineering activities and related technical consultancy	27,623
744	Advertising	13,747
748	Other economic activities (as photography and design)	2,020
921	Motion picture and video activities	11,032
922	Radio and television activities	7,697
924	News agency activities	256
925	Library archives, museums and other cultural activities	2,166
	Total employment in Creative Service Industries (CSIs)	111,380

Source: Own elaboration with data from IDESCAT and following UNCTAD (2008).

The dataset of the local characteristics of all 946 Catalan municipalities is mainly taken from Trullén and Boix-Domenech (2005), the Catalan Statistical Institute (Census 2001, IDESCAT) and the Catalan Cartographical Institute. IVs are taken from the ISOCAC-URV database provided by Arnabat and Ferré (2015) and the Spanish Statistical Institute (INE). Table 5 shows some

descriptive statistics of these variables. More information regarding the correlation between explanatory variables and IV is shown in Table 6.

Table 5. Summary Statistics

Variable	Description	Source	N	Mean	Std. Dev.	Min	Max
firm_entries	Sum of the number of firm entries (02–07) (Ln)	REIC 2002-2007	946	1.27	1.33	0.00	6.70
puni	Educational level: Graduate relative to number of jobs (Ln)	IDESCAT (2001)	946	-1.88	0.38	-3.76	-0.69
ptech	Educational level: Technical studies relative to number of jobs (1st and 2nd degree) (Ln)	IDESCAT (2001)	946	0.15	0.04	0.00	0.31
pop_density	Population density (Ln)	IDESCAT (2001)	946	3.77	1.86	-0.20	9.85
job_pop	Ratio of number of jobs per population (Ln)	IDESCAT (2001)	946	0.36	0.04	0.00	0.46
income	Average Income Tax for taxpayer (Ln)	IDESCAT (2001)	946	9.073	0.369	7.664	10.402
job_ind	Percentage of industrial employment	IDESCAT (2001)	946	0.20	0.09	0.00	0.48
psmall	Percentage of small firms in the municipality	IDESCAT (2001)	946	0.60	0.15	0.00	0.69
dist_pro	Distance to the province capital (Ln)	Trullén and Boix (2005)	946	10.42	1.02	0.00	11.82
altitude	Altitude (Ln)	Trullén and Boix (2005)	946	5.39	1.23	1.10	7.34
seaside	It indicates if the municipality is beside the sea (1) or not (0)	Trullén and Boix (2005)	946	0.07	0.26	0.00	1.00
CSI	Employment in creative service industries (Ln)	IDESCAT (2001)	946	1.76	1.78	0.00	11.03
d_nineteenth	It indicates if the municipality has any cultural association created in the nineteenth century (1) or not (0)	Arnabat and Ferré (2015)	946	0.22	0.41	0.00	1.00
d_00_35	It indicates if the municipality has any cultural association created between 1900 and 1935 (1) or not (0)	Arnabat and Ferré (2015)	946	0.36	0.48	0.00	1.00
pop_1900	Total number of inhabitants in 1900 (Ln)	INE (1900)	946	6.88	0.89	1.10	13.20

Table 6. Correlation between independent variables

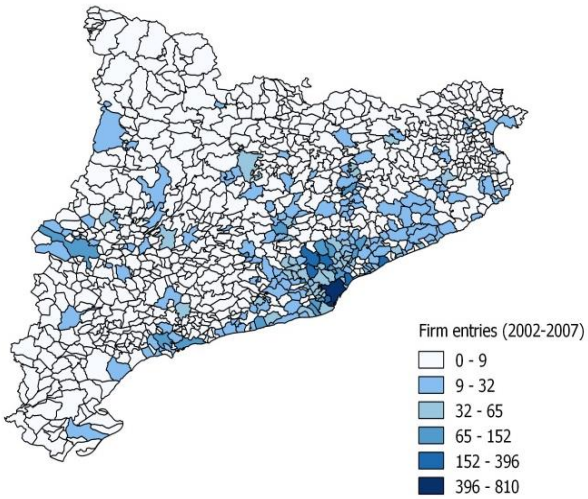
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. puni	1													
2. ptech	0.1122*	1												
3. pop_density	-0.0125	-0.0346	1											
4. job_pop	0.1282*	0.041	0.1402*	1										
5. income	0.3787*	-0.034	0.3348*	0.4850*	1									
6. job_ind	-0.1883*	0.1139*	0.2831*	0.2432*	0.2269*	1								
7. psmall	0.0785*	-0.0338	-0.1589*	-0.2447*	-0.2381*	-0.3726*	1							
8. dist_pro	-0.0770*	-0.0281	-0.1657*	-0.0799*	-0.2104*	-0.0658*	0.1649*	1						
9. altitude	0.0853*	0.1838*	-0.3143*	0.0273	-0.2611*	0.047	0.0984*	0.3743*	1					
10. seaside	0.0321	-0.1027*	0.2183*	-0.0047	0.2085*	-0.1598*	-0.0435	-0.1148*	-0.5477*	1				
11. CSI	0.0589	-0.003	0.5438*	0.2592*	0.5082*	0.3301*	-0.3975*	-0.3727*	-0.4252*	0.3717*	1			
12. d_nineteenth	-0.0285	-0.0456	0.2961*	0.0565	0.1807*	0.2224*	-0.1643*	-0.0884*	-0.1529*	0.1619*	0.4459*	1		
13. d_00_35	-0.0211	-0.0141	0.2582*	0.0015	0.1632*	0.1976*	-0.1466*	-0.1059*	-0.1822*	0.1502*	0.3966*	0.4268*	1	
14. pop_1900	-0.0525	-0.0602	0.2709*	-0.0356	0.0463	0.1779*	-0.1940*	-0.2179*	-0.2191*	0.2538*	0.6028*	0.4507*	0.3970*	1

Note: Significance level: *p<0.05

4.1 Spatial distribution of firm entries and employment in creative service industries

Figure 2 depicts the spatial distribution of firms located in Catalan municipalities between 2002 and 2007. Roughly 75% of new and relocated firms were agglomerated in the Metropolitan Area of Barcelona (MAB) and to a lesser extent around the other provincial capitals. It seems clear, then, that one of the most essential determinants of a firm's location decision are agglomeration economies, the advantages of which (specialised labour markets, availability of suppliers and knowledge spillovers) only exist in dense areas.

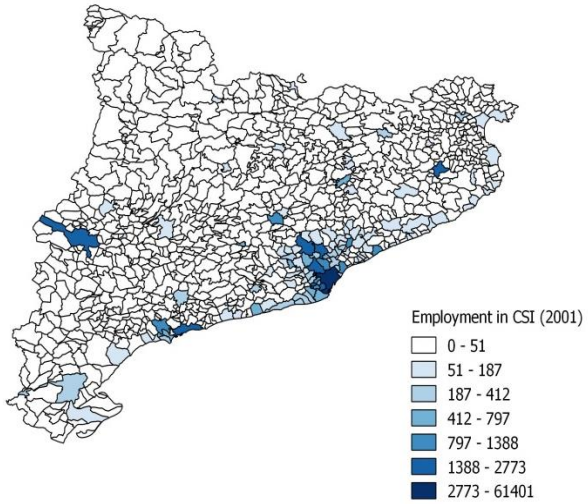
Figure 2. Spatial distribution of new plants (2002–2007)



Source: Own elaboration using REIC's data.

Figure 3 shows the spatial distribution of employment in CSIs. Generally speaking, higher levels for this variable are reported near MAB whilst in inland and mountain areas employment in CSIs is almost non-existent. In these latter areas, municipalities are less populated, so they have a less diversified industrial structure, which prevents them from developing an environment conducive to enhancing CIs.

Figure 3. Spatial distribution of employment in creative services industries



Source: Own elaboration using Census 2001 (IDESCAT).

5. Results

5.1. Do historical cultural associations explain employment in CSIs?

In Section 2, it was claimed that, nowadays, the creation of cultural associations in the nineteenth and the first part of the twentieth centuries still influences the concentration of creative employment. Now this hypothesis is empirically tested for all (946), metro (420) and non-metro (526) Catalan municipalities. The metropolitan and non-metropolitan sub-samples are obtained by using a dummy variable defined by Trullén and Boix-Domenech (2005) for Catalan municipalities. Although employees in CSIs are assumed to be concentrated in metropolitan areas, there are several exceptions. Therefore, by making this distinction it was determined whether significant differences in location determinants exist between the two areas.

The first goal of this chapter is to estimate the effect of these three historical variables on the number of employees in CSIs. OLS regressions grouped in three panels are presented in Table 7. The dependent variables include the number of employees in CSIs in all Catalan municipalities (Panel A), the number of employees in CSIs in metro Catalan municipalities (Panel B) and the number of employees in CSIs in in non-metropolitan Catalan municipalities (Panel C). As in Lee (2014), the number of employees in CSIs reflects the concentration of creative talents. The main explanatory variables are a dummy indicating the creation of cultural associations in the nineteenth century (columns 1, 4 and 7), a dummy indicating the creation of cultural associations between 1900

and 1935 (columns 2, 5 and 8) and the population in 1900 (columns 3, 6 and 9).[25] Finally, some control variables are included.

The results in Table 7 clearly show that cultural associations are associated with present new firm creation. In Panel A, all three historical variables are positively related to the number of employees in CSIs in 2001.[26] The overall R^2 of the preferred specification in column 3 is 73%. At the metropolitan and non-metropolitan levels (Panel B and C) all three historical variables are also significant and have the expected positive sign. The preferred specifications are in columns 6 and 9 and show an overall R^2 of around 79% and 68% for metro and non-metro subsamples, respectively.

[25] The main source of data for determining the historical urban population in 1900 is the Instituto Nacional de Estadística (INE) and includes the census carried out every ten years from 1900 until 1981 when censuses moved to years ending in 1. Therefore, there is information from 11 censuses between 1900 and 2001. These censuses provide total number of inhabitants at a local (municipality) level in Catalonia. As number of municipalities change during the twentieth century, all of them are included through the census in which they appear for the first time. This empirical strategy implies that departing from 886 municipalities in 1900, it ends up with 946 in 2001 (Goerlich et al. 2006).

[26] These results provide cautious support for the idea that a causal effect exists because they are first step results and there may be an omitted variable bias, for instance the local wealth could explain both higher past cultural associations and contemporaneous employment in CIs. Even if this issue is mainly controlled by 1900 population, the use of local wealth in 1900 could even provide more accurate results. More work is needed to confirm this finding.

Table 7. CSIs employment as a function of historical cultural associations and population

	Panel A: All municipalities			Panel B: Metro			Panel C: Non-Metro		
Dep. Var. : CSI	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS	OLS
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
d_nineteenth	0.957***	0.773***	0.292***	0.853***	0.707***	0.266*	1.046***	0.855***	0.371***
	(0.110)	(0.112)	(0.0983)	(0.138)	(0.142)	(0.140)	(0.161)	(0.159)	(0.119)
d_00_35		0.451***	0.161**		0.359***	0.128		0.476***	0.148*
		(0.0852)	(0.0759)		(0.120)	(0.110)		(0.106)	(0.0877)
pop_1900			0.767***			0.620***			0.887***
			(0.0674)			(0.117)			(0.0562)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-4.197***	-4.257***	-13.95***	-6.201***	-6.227***	-14.60***	-7.523***	-7.550***	-16.79***
	(1.257)	(1.224)	(1.471)	(2.286)	(2.239)	(2.859)	(1.713)	(1.680)	(1.530)
N	946	946	946	420	420	420	526	526	526
Adjusted R^2	0.625	0.636	0.732	0.735	0.740	0.788	0.452	0.474	0.678
First-stage statistic	75.949	52.33	89.995	38.308	22.848	27.617	42.246	30.908	114.399
Overid. *p*-value	-	-	0.7899	-	-	0.6140	-	-	0.322

Notes: Controls include the following variables: puni, ptech, pop_density, job_pop, income, job_ind, psmall, dist_pro, altitude, and seaside.

Robust standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1.

It is important to notice that the above results are first-stage results, in which historical cultural associations and population are studied as instruments for present new firm creation. The use of historical instruments is not new in the literature (see, for instance, Duranton and Turner 2011 or García-López et al. 2015). However, the use historical IVs to explain the economic dynamism potential of CIs is new in this literature. While Wojan et al. (2007b) and Chapter 2 of this thesis follow a two-step process to estimate an unobservable *creative milieu*, this chapter uses an alternative procedure to deal with possible omitted variables and reverse causality. Moreover, the use of historical IVs makes it possible to capture municipalities that are tolerant, creative, proactive and venturesome.

Instruments need to be relevant, and they seem to fulfill this requirement. First, common sense suggests that present employment in CIs does not depend on the creation of cultural associations in the nineteenth century / beginnings of the twentieth century. On the contrary, the current concentration of cultural and creative employment largely depends on the historical urban development path and cultural embeddedness of each city (Bonfanti et al. 2015; Pareja-Eastaway and Pradel-i-Miquel 2014). Second, the preferred specifications in Table 4 show positive and significant point estimates for the selected instruments, and high over-all R^2.[27] Finally, they also show first-stage statistical values that are above Stock and Yogo's rule of thumb ($F > 10$) and near Stock and Yogo's critical values (2005) for the size test in the context of TSLS estimation.

The IVs need to be exogenous. Cultural associations may be exogenous because of the time that has passed since they were created and the significant changes undergone by society and economy in the intervening years. Furthermore, they were not created with the purpose of attracting more firm entries 150 years later. As discussed in Section 2, cultural associations arise from the social need to alleviate inequalities, guarantee a dignified life and contribute to the formation and *culturalisation* of the people.

However, it is also true that other factors, in particular demographic issues, could have influenced the development of cultural associations. These factors may also have affected present firm entries. Since there tends to be more cultural associations in the nineteenth century and between 1900 and 1935 in the most populated municipalities, to some extent these IVs may predict the dependent variable both directly and indirectly by employment in CSIs. According to Duranton and Turner (2011, 2012), the exclusion restriction requires the orthogonality of the dependent variable and the instruments to be conditional on control variables. Therefore, the inclusion of the historic urban population in 1900 should fulfil the exogeneity condition.

[27] These historical IV contribute to the regression without including control variables by an overall R^2 of 41%, 40% and 50%, for all, metro and non-metro municipalities respectively.

In summary, according to the above first-stage results, the three historical variables considered in this study, the creation of cultural associations in the nineteenth century and between 1900 and 1935, and the population in 1900, provide a set of non-weak and relevant instruments. According to the above comments, these instruments are also believed to be exogenous.[28]

5.2. Does employment in CSIs cause new firm creation in Catalonia? OLS results

Table 8 Panel A shows the main OLS and IV baseline model results in columns 1-4 for all Catalan municipalities. The estimated coefficient of interest in the OLS regression in column 1 shows that employment in CSIs has a positive and significant effect on new firm creation. In columns 2-5, employment in CSIs is instrumented with a dummy of the creation of cultural associations in the nineteenth century (column 2), a dummy of the creation of cultural associations between 1900 and 1935 (column 3) and the historical population in 1900 (column 4). In general, all TSLS results clearly show that employment in CSIs have a positive and significant effect on new firm creation. It is important to notice that the estimated coefficient is quite stable across the different TSLS specifications, even when the variable historical population is used as an instrument and all the other control variables are used as traditional factors of industrial location. Comparing OLS and TSLS results, the absolute value of *CSI* on firm entries in the TSLS specification is much higher than the OLS coefficient for all subsamples, so the OLS estimates are biased downwards. Larger employment in CSIs, aside from meaning higher levels of creativity on the municipality, reflects better unobserved contemporaneous neighbourhood amenities in the OLS specification, biasing the coefficient towards zero. According to the control variables, the first-stage statistic and the overidentification p-value[29], the preferred specification is in column 4 and its results indicate that by increasing employment in CSIs by 10%, the number of new firms located in the municipality increases by 6.7%. These results remain consistent for metro and non-metro municipalities (Panels B and C in Table 8). However, this effect is larger for metro municipalities (8.7%) than for non-metro municipalities (5.7%).

Although the main aim is to analyse the effects of CSIs employment on new firm creation, it may be interesting to analyse the results for of the other location determinants. The coefficients analysed for the OLS results of all Catalan municipalities are shown in Table 8 Panel A column 1. Agglomeration economies, proxied by population density, act positively; higher income levels, greater distances from provincial capitals are correlated with lower entries; manufacturing workforce shares are correlated with positive entries but SME are correlated with lower entries (see

[28] Previous contributions that make use of historical IVs and a similar strategy, but in other contexts, are the following: Duranton and Turner (2011, 2012), García-López et al. (2015) or Hellmanzik (2016).

[29] The overidentification test (or Hansen-Sargan test) assesses the validity of overidentifying instruments (Cameron and Trivedi 2010). With a p-value higher than 0.05 it is not possible to reject the null hypothesis that all instruments are valid and conclude that the overidentifying restriction is valid.

Arauzo-Carod and Manjón-Antolín 2012). Educational characteristics have opposite correlations because technical studies are positive for firm location while higher educational levels are negative, as is shown by many other analyses (see Arauzo-Carod and Manjón-Antolín 2004; Arauzo-Carod and Viladecans-Marsal 2009; among others). Returning to the issue of possible endogeneity, some authors argue that human capital can capture the effects of the concentration of creativity (Glaeser 2004). However, our results show that the correlation of employment in CSIs on the creation of new firms is still significant when human capital variables are added. These results remain consistent for metro and non-metro municipalities (Panels B and C in Table 8).

5.3. Does employment in CSIs cause firm entries in Catalonia? CDM results

One concern with the above approach is that estimating the number of firm entries with OLS could lead to potential coefficient bias. So, this chapter makes use of two-step estimation to control for endogeneity following Cameron and Trivedi (2010). As explained in Section 3, this two-step procedure needs to be estimated by a bootstrap method instead of robust cluster errors since the p-value of the z statistic for the coefficient of the latent factor generated in the first step before being included in the second step (Res) is different from zero in this case.

Therefore, Table 9 compares robust OLS results (column 1) without making use of a bootstrap two-step procedure for Poisson (column 2) and Negative binomial models (column 3). Results confirm that even when using this alternative empirical approach the positive and significant effect of having higher levels of employment in CSIs enhances the location of new firms in the municipality. The negative coefficient of *Res* can be interpreted to mean that the latent factor, which increases the probability of having more employees in CSIs in the municipality, lowers the number of firm entries. This result is consistent if we think of all the unobservable characteristics of the municipality that can influence both the concentration of CSIs and firm creation. Controlling for endogeneity has a substantial effect on firm entries explained by an exogenous change in employment in CSIs because its coefficient is now much higher.

Table 8. Firm entries as a function of CSIs employment (baseline model)

	Panel A: All municipalities				Panel B: Metro				Panel C: Non-Metro			
Dep. Var. :	OLS	TSLS	TSLS	TSLS	OLS	TSLS	TSLS	TSLS	OLS	TSLS	TSLS	TSLS
Firm entries	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
CSI	0.566***	0.667***	0.682***	0.665***	0.644***	0.796***	0.793***	0.869***	0.520***	0.561***	0.609***	0.564***
	(0.0192)	(0.0615)	(0.0558)	(0.0327)	(0.0275)	(0.0964)	(0.0937)	(0.0587)	(0.0283)	(0.0754)	(0.0668)	(0.0390)
puni	-0.232***	-0.235***	-0.235***	-0.235***	-0.341***	-0.307**	-0.307**	-0.290**	-0.154**	-0.158**	-0.164**	-0.159**
	(0.0638)	(0.0639)	(0.0641)	(0.0638)	(0.119)	(0.120)	(0.120)	(0.124)	(0.0745)	(0.0739)	(0.0742)	(0.0736)
ptech	0.942*	0.849	0.835	0.851*	0.782	0.904	0.902	0.963	0.863	0.856	0.848	0.856
	(0.511)	(0.520)	(0.521)	(0.516)	(0.898)	(0.920)	(0.919)	(0.951)	(0.632)	(0.628)	(0.634)	(0.628)
pop_density	0.0526***	0.0241	0.0199	0.0248	0.0424*	-0.0236	-0.0222	-0.0553	0.0246	0.0203	0.0152	0.0199
	(0.0144)	(0.0220)	(0.0208)	(0.0165)	(0.0244)	(0.0477)	(0.0464)	(0.0337)	(0.0184)	(0.0194)	(0.0190)	(0.0184)
job_pop	1.196*	1.107	1.094	1.109	1.454	1.428	1.429	1.416	1.107	1.007	0.889	0.998
	(0.713)	(0.711)	(0.714)	(0.706)	(1.025)	(0.986)	(0.986)	(1.001)	(1.019)	(1.035)	(1.049)	(1.014)
income	-0.0468	-0.152	-0.167*	-0.149*	-0.271*	-0.476***	-0.472***	-0.574***	0.0766	0.0430	0.00291	0.0399
	(0.0831)	(0.0999)	(0.0957)	(0.0900)	(0.144)	(0.180)	(0.175)	(0.157)	(0.103)	(0.116)	(0.111)	(0.108)
job_ind	1.400***	1.121***	1.079***	1.127***	1.686***	1.385**	1.391**	1.240**	0.900**	0.748*	0.567	0.734*
	(0.282)	(0.324)	(0.319)	(0.293)	(0.554)	(0.614)	(0.615)	(0.613)	(0.373)	(0.435)	(0.411)	(0.380)
psmall	-0.236	0.00224	0.0380	-0.00346	0.414	0.874**	0.864**	1.095***	-0.601***	-0.545**	-0.477**	-0.540**
	(0.174)	(0.221)	(0.212)	(0.186)	(0.289)	(0.410)	(0.403)	(0.369)	(0.219)	(0.236)	(0.229)	(0.216)
dist_pro	-0.0676***	-0.0364	-0.0317	-0.0371	0.000917	0.0618	0.0605	0.0911***	-0.346***	-0.357***	-0.370***	-0.358***
	(0.0223)	(0.0304)	(0.0297)	(0.0259)	(0.0204)	(0.0444)	(0.0433)	(0.0316)	(0.0788)	(0.0794)	(0.0798)	(0.0782)
altitude	0.0174	0.0299	0.0318	0.0296	0.0552	0.0737	0.0733	0.0825	0.0590**	0.0670**	0.0764**	0.0677**
	(0.0234)	(0.0252)	(0.0254)	(0.0244)	(0.0486)	(0.0506)	(0.0506)	(0.0523)	(0.0290)	(0.0319)	(0.0321)	(0.0295)
seaside	-0.118	-0.263*	-0.284**	-0.259**	0.00734	-0.126	-0.123	-0.190	-0.134	-0.204	-0.287	-0.210
	(0.111)	(0.149)	(0.143)	(0.123)	(0.158)	(0.194)	(0.194)	(0.186)	(0.153)	(0.200)	(0.187)	(0.158)
Constant	-0.0185	0.433	0.501	0.423	0.349	1.329	1.308	1.800	2.288*	2.649**	3.079**	2.682**
	(0.772)	(0.819)	(0.812)	(0.804)	(1.378)	(1.491)	(1.467)	(1.475)	(1.231)	(1.344)	(1.298)	(1.254)
N	946	946	946	946	420	420	420	420	526	526	526	526
Adjusted R^2	0.743	0.735	0.733	0.736	0.805	0.792	0.793	0.777	-	0.600	0.598	0.591
First-stage statistic	-	75.949	52.33	89.995	-	38.308	22.848	27.617	-	42.246	30.908	114.399
Overid. *p*-value	-	-	-	0.7899	-	-	-	0.6140	-	-	-	0.322
Instruments												
d_nineteenth	N	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y
d_00_35	N	N	Y	Y	N	N	Y	Y	N	N	Y	Y
pop_1900	N	N	N	Y	N	N	N	Y	N	N	N	Y

Notes: Robust standard errors in parentheses. *** p<0.01; ** p<0.05; * p<0.1

Table 9. Firm creation as a function of CSIs employment using CDM

	All municipalities		
Dep. Var. :	OLS	Poisson[a]	NB[b]
Firm entries	(1)	(2)	(3)
CSI	0.566***	0.778***	0.885***
	(0.0192)	(0.049)	(0.057)
puni	-0.232***	-0.652***	-0.544***
	(0.0638)	(0.150)	(0.152)
ptech	0.942*	2.342*	3.636
	(0.511)	(1.313)	(2.097)
pop_density	0.0526***	0.019	-0.044
	(0.0144)	(0.024)	(0.031)
job_pop	1.196*	4.809**	2.575*
	(0.713)	(1.849)	(1.787)
income	-0.0468	-0.151	0.089
	(0.0831)	(0.228)	(0.598)
job_ind	1.400***	2.380***	1.880**
	(0.282)	(0.613)	(0.598)
psmall	-0.236	0.988**	0.481
	(0.174)	(0.333)	(0.371)
dist_pro	-0.0676***	0.055*	0.012
	(0.0223)	(0.031)	(0.071)
altitude	0.0174	0.108**	0.003
	(0.0234)	(0.056)	(0.046)
seaside	-0.118	0.052	-0.038
	(0.111)	(0.197)	(0.199)
Res (1st Step)	-	-0.155**	-0.293**
		(0.068)	(0.073)
Constant	-0.0185	-4.454***	-3.386***
	(0.772)	(2.116)	(0.075)
N	946	946	946
Ln_alpha	-	-	-0.319**
			(1.163)
Instruments			
d_nineteenth	N	Y	Y
d_00_35	N	Y	Y
pop_1900	N	Y	Y

Notes: Bootstrap standard errors in parentheses. [a] and [b] : 400 simulations.

*** p<0.01; ** p<0.05; * p<0.1.

6. Conclusions

This chapter tries to contribute to the literature on CIs by addressing potential reverse causality between CIs and economic dynamism. In particular, it investigates two questions: 1) Do cultural associations capturing the unobservable local identity of a municipality explain the present concentration of creative employment? And 2) Do creative industries lead to new firm location? By

using, cultural associations and urban population as historical IVs, the results confirm the potential of CIs for firm creation. The main results show that by increasing employment in CSIs by 10% the number of firms located in the municipality increases by 6.7% for all municipalities, 8.9% for metro municipalities and 5.9% for non-metro municipalities. These results are robust across Catalan metro and non-metro municipalities, and also across different empirical approaches (from robust OLS, passing through TSLS, to CDM). These results support the view that CIs lead to economic dynamism (i.e., firm creation) in the local economy. Furthermore, analysis of IVs suggests that the intrinsic and historical personality defining the municipality – in terms of cultural associations – should explain the attraction of creative employment to the municipality and, at the same time, this should encourage the location of new firms.

The contribution of this chapter is relevant because it provides new evidence to the literature on CIs. In terms of previous empirical contributions, these results are in line with the findings by Lee (2014) and support the positive association between entrepreneurship and *creative milieu* claimed by Wojan et al. (2007b) and in Chapter 2 of this thesis. On the other hand, these results also support the association between the concentration of employment in CSIs and new firm creation at a municipality level (Scott 2000; Lee et al. 2004; Stam et al. 2008). Furthermore, they do corroborate contributions arguing that CIs are especially attracted to those intangible characteristics of municipalities (Scott 2006). In fact, the relevance of cultural associations to employment in CSIs and the resulting higher significance of this employment in CSIs on new firm creation strongly suggest that for the potential in terms of local economic growth of CIs, the role of cultural dynamism path patterns and a strong identity are important (Pareja-Eastaway and Pradel-i-Miquel 2014).

These results have implications for policy. On the one hand, they corroborate the potential of CIs for economic growth, as they may drive economic dynamism. Thus, policies promoting firm entry should focus on providing and improving the local features and conditions that enhance the concentration of employment in CIs (i.e., networking possibilities, cultural infrastructures, diversity of people and activities, place-specific image, etc.). On the other hand, creativity-based policies aiming to enhance local competitiveness should take into account cultural path dependence and the historical context of their municipalities. At the same time, however, this means that public efforts to attract creative employment might not be as successful as in those areas with strong cultural path dependence.

Despite all this, this study does have some limitations. In this regard, any future research should focus on looking for alternative datasets that will make it possible to produce panel data to control for any remaining source of unobservable heterogeneity. Also the use of alternative historical IVs and their application to other regions would also support the results found in this chapter. Since this data is not available at present, these issues are left for future research.

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Chapter 4

Agglomeration of creative industries: An intra-metropolitan analysis for Barcelona[30]

1. Introduction

The uncertainty of continuous technological changes in an increasingly globalised world has put pressure on governments to redirect their economies and societies towards creativity (UNCTAD 2010; Flew 2010). It is precisely in this context where creative industries emerge as new sources of local economic growth, development and competitiveness through their role in the innovation and industrial mix reconfiguration process (UNCTAD 2010; Potts 2011; Pareja-Eastaway 2016). Creative industries (CIs) are defined as a set of economic activities that use creativity as main input and that provide tangible or intangible goods or services with creative content and economic value potentially generating revenues from trade and intellectual property rights (UNCTAD 2010). Concretely, CIs include activities like arts, advertising, cinema, fashion, publishing, R&D or software. The increasing importance of these industries has been reflected in an increase in the number of publications in various areas of study, one of the most important of which is the spatial organization of CIs (see, for example, O'Connor 2010).

CIs are closely linked to aesthetics and symbolic values and are characterised by a project-based, contractual, and time-dependent working nature requiring constant explicit and tacit contact within formal and informal networks. For this reason, advantages to being agglomerated in the same areas exist for workers employed in CIs and small and medium enterprises (SME) (Caves 2000; Pareja-Eastaway 2016). Along these lines, the literature on the location patterns of CIs suggests that CIs have a greater need for agglomeration[31] than Non-CIs (Scott 1997; Scott et al. 2001; Asheim et al.

[30] The paper in this chapter is co-authored with A.I. Moreno-Monroy and J.M. Arauzo-Carod. It has already been published in the *Papers in Regional Science*.

[31] In this paper the terms 'agglomeration' and 'concentration' are used indistinctively. Although in the literature the process of spatial concentration is sometimes referred to as 'clustering', not all spatial concentrations are 'clusters' if they are defined as 'a socioterritorial entity which is characterised by the active presence of both a community of people and a population of firms in one naturally and historically bounded area' (Becattini 1991). As this definition suggests, there are advantages linked to the concentration of similar firms inside industrial districts. The empirical application applied in this chapter does not allows to identify

2007; Andersson et al. 2014)[32]. Geographical proximity facilitates the exchange of knowledge, particularly if knowledge is tacit and context-specific, since it requires repeated contact with others (see for instance, Scott 1997; Banks et al. 2000; Lazzeretti et al. 2008, 2012; or Plum and Hassink 2014). However, agglomeration externalities, especially those associated with knowledge spillovers, are known to decay rapidly over space (Rosenthal and Strange 2008; Arzaghi and Henderson 2008). Measurement of the intensity and spatial extent of the agglomeration of CIs in urban areas is therefore relevant for two main reasons: 1) to test whether the need of CIs for agglomeration is actually stronger than the other economic activities; and 2) to estimate up to which distance the agglomeration of creative activities is significant. These questions are important for local economic development policies that focus on urban regeneration, the attraction of skilled workers and the generation of creative and innovative environments. Nevertheless, the intensity and spatial extent of the agglomeration and coagglomeration of CIs within urban areas has not yet been clearly identified in the literature (e.g. Cooke and Lazzeretti 2008; De Propris et al. 2009; Lazzeretti et al. 2012).

This chapter provides a comprehensive intra-metropolitan analysis of the intensity and extent of the agglomeration and coagglomeration of CIs within the Metropolitan Area of Barcelona (MAB). To do so, UNCTAD's classification of CIs is followed and it tests whether the strength and extent of CIs agglomeration differs from that of non-creative industries (non-CIs) and whether these patterns change across different CIs sectors. It also examines whether different CIs coagglomerate. To deal with methodological limitations arising from the use of geographically aggregated data and area-based methods, geo-referenced data for the MAB is used in order to calculate the relative distance-based M and m cumulative and density functions of agglomeration and coagglomeration (Marcon and Puech 2010; Lang et al. 2016).

This chapter adds to a growing literature on the spatial distribution of economic activity using distance-based methods (Deurloo and De Vos 2008; Arbia et al. 2014; Behrens and Bougna 2015; Moreno-Monroy and Garcia 2016). This is the first chapter to use two complementary distance-based measures to analyse the agglomeration patterns of creative firms: the M- and m-functions of agglomeration. The M-function provides information on the strength and significance of

'clusters' because there is not a way to measure the degree of local interaction and the benefits and costs of concentration. For this reason, the terms 'clusters' and 'clustering' throughout are avoided.

[32] Some clarifications are in place here. Scott (1997) focuses mainly on cultural industries rather than on creative industries. However, according to UNCTAD (2010) the two terms are sometimes used interchangeably because, 'defined in either or both of these ways, "cultural goods and services" can be seen as a subset of a wider category that can be called "creative goods and services", whose production requires some reasonably significant level of creativity'. Andersson et al. (2014) focus on the agglomeration of creative workers rather than on the agglomeration of CIs.

agglomeration and coagglomeration up to a certain distance, while the relative m-function provides this information at a given distance. These functions provide a comprehensive and unbiased analysis of the spatial structure of the distribution of CIs. By building counterfactual location simulations, it is possible to quantify agglomeration or dispersion results, and also to detect up to/at which distance the statistically significant agglomeration of CIs occur compared to the other economic activities within the urban area (Marcon and Puech 2012). Even though the effect of agglomeration economies on firms' location decisions cannot be identified, with this approach it is possible to assess in more detail whether agglomeration effects are highly localised (i.e. in a range of 1 or 2 km) or whether they reach longer distances (e.g. 10 or 15 km). In this sense, the findings of this chapter can inform decisions on whether to promote short-distance or long-distance creative clusters.

This chapter is focused on the MAB, one of the largest metropolitan areas in the European Union in terms of creative employment. Specifically, in 2012 more than 100,000 people were employed in CIs. This represents more than 10 per cent of the total number employed in Barcelona alone (IERMB 2013). The importance of CIs in the metropolitan area is due to the transformation Barcelona has undergone since the 1990s into an economy that is oriented towards innovation, creativity and culture. Despite the importance of Barcelona, there is little evidence on the agglomeration of CIs in the area (except for Boix-Domenech et al. 2013, 2015). Against this background, this chapter provides notable implications. On the one hand, analysing the agglomeration and coagglomeration of CIs from a continuous space point of view enables to identify the extent of agglomeration economies for CIs within the MAB. On the other hand, several recent studies have found that Barcelona already has great potential as a magnet for the young and skilled population but little potential to distribute this population among the various parts of the city (López-Gay 2016). Policies dealing with urban regeneration and socio-economic polarization should therefore be reshaped in accordance with the spatial extent of the agglomeration of the CIs.

The role of the geographical proximity between creative firms has mostly been analysed using aggregated data and area-based measures. Previous findings are therefore subject to the modifiable areal unit problem (MAUP)[33], which can be overcome by using distance-based methods (Duranton and Overman 2005; Marcon and Puech 2010). So far, most contributions have worked with spatial concentration indices (e.g. location quotients), correlation techniques (e.g. Pearson and Spearman coefficients), spatial autocorrelation measures (e.g. Moran's I and LISA), and hotspot mapping tools. Examples of these contributions are Scott (2000), De Propris et al. (2009), Lazzeretti et al. (2012), and Cruz and Teixeira (2014b, 2015a) for the European Union and Currid (2006), Catungal et al. (2009), Currid and Williams (2010) for North America. The only chapter that has used

[33] The MAUP appears when the same analysis is applied to the same data but different aggregation schemes are used, leading to biased results. See Arbia (2001) for more details.

distance-based methods to analyse the location patterns of CIs is Boix-Domenech et al. (2015). These authors applied the spatial nearest neighbour clustering algorithm (NNC) to a continuous space for selected European countries and showed that CIs are highly agglomerated and coagglomerated in large European metropolitan areas. While Boix-Domenech et al. (2015) studied both inter-metropolitan and intra-metropolitan location patterns, in this chapter the intensity and extent of the agglomeration of CIs is calculated by taking into account the spatial distribution of all other activities within a large metropolitan area. Moreover, like the NNC, the methodology used in this chapter (M- and m-functions) also satisfies the main requirements of a good concentration measure. In addition, it controls for inhomogeneous space, provides the statistical significance of the agglomeration at each distance, and makes it easier to interpret the results (Marcon and Puech 2003, 2010; Lang et al. 2016).

Main results show that CIs and non-CIs have different agglomeration patterns. Specifically, a high agglomeration of CIs at short distances and a rapid distance decay of this agglomeration are found. This pattern of high levels of agglomeration at short distances and rapid decay holds for individual CI sectors. In this sense, the spatial extent of the agglomeration of CIs is very short (they are mainly concentrated between 0 and 1 km). A clear coagglomeration between CIs and non-CIs is found only for firms with less than 10 workers. Coagglomeration among symbolic-based creative sectors is also found. On the other hand, other knowledge-based creative firms (such as R&D companies) and those in mature industries (such as printing) seem to be highly agglomerated but do not coagglomerate in the same areas as the other CIs, possibly because they are in less need of tacit interaction and specific environments than symbolic-based CIs. These results suggest that CIs have strong specificities in terms of their location patterns and that they agglomerate in particular areas (neighbourhoods) within the city, where they easily find networks among creative disciplines, cultural infrastructures, and a higher concentration of demand for creative and cultural goods and services.

This chapter is structured as follows. Section 2 reviews the main factors behind the agglomeration and coagglomeration of CIs. Section 3 presents the methodological approach and data. Section 4 presents main results. Finally, Section 5 discusses main conclusions.

2. What explains CI agglomeration and coagglomeration?

Interest in studying the location behaviour of CIs is linked to the unique characteristics of these industries: their propensity for project work and networking; their need for continuous novelty and innovation closely associated with aesthetics and symbolic values (Caves 2000); and their potential for economic growth as a source of innovation (Potts 2009, 2011).

Previous analyses of the location patterns of CIs underline their tendency to be highly concentrated in space (Cooke and Lazzeretti 2008; Lazzeretti et al. 2008, 2012). This concentration has been associated with agglomeration economies, which are defined as the benefits that derive from the spatial concentration of jobs and firms. According to Hoover (1936), agglomeration economies are subdivided into localisation economies (mainly associated with Marshall 1920) and urbanisation economies (mainly associated with Jacobs 1961, 1969). With regard to localisation economies, CIs may agglomerate with firms in the same industry to take advantage of local knowledge spillovers and benefit from pooled specialised labour markets and the availability of local suppliers who are specialised in other parts of the creative *filière* (Landry 2000; Florida 2002a; Maskell and Lorenzen 2004; Scott 2006; Santagata and Bertacchini 2011; Lazzereti et al 2012; Branzanti 2014).

With regard to urbanisation economies, CIs coagglomerate in order to take advantage of the diversity of economic activities and people and of the capacity of local consumption markets (Lorenzen and Frederiksen 2008; Lazzeretti et al. 2012). Diversity can facilitate coordination among diverse knowledge bases, and their geographical proximity promotes knowledge flows, the spread of ideas, and new forms of entrepreneurship among different agents and industries (Glaeser et al. 1992; Flew 2010). In this sense, recent contributions highlight that only the cross-fertilization of different creative talents working in different fields may stimulate creativity, ultimately enhancing regional development (Cerisola 2016, 2017). At the same time, from a demand-side perspective, the coagglomeration of CIs in urban areas may be explained by the fact that in cities firms have access to a wider range of consumers' preferences and higher average consumption levels of cultural goods and services (Heilbrun 1996; Glaeser et al. 2001; Turok 2003; Currid and Williams 2010).

In short, coagglomeration enables firms to benefit from the effects of static and dynamic increasing returns (e.g. flexible subcontracting opportunities, learning and innovation phenomena, entrepreneurial spinoff possibilities, etc.). On the other hand, CIs may require greater concentration for their economic and social interactions (Scott 2000; Banks et al. 2000; Currid and Williams 2010). Moreover, bearing in mind previous findings that have highlighted the attraction of economic activities to CIs due to their knowledge spillovers in terms of creativity and innovation (Lee et al. 2004; De Jong et al. 2007), a significant coagglomeration between CIs and non-CIs is expected. This coagglomeration should be more intense between smaller firms since they have a greater need for concentration to gain access to other services and lower transaction costs compared to larger firms (Scott 1988). In the case of CIs, coagglomeration between small CIs is even more important due to the high levels of uncertainty, instability, and complexity that characterise these industries (Scott et al. 2001; Asheim et al. 2007; Pareja-Eastaway 2016).

While the above factors may be relevant for explaining the different degrees of agglomeration and coagglomeration across CI sectors, perhaps the most distinctive factor in these industries is their type of dominant knowledge base. All three existing definitions of knowledge base for innovative

and creative activities – analytical, synthetic and symbolic – are defined according to a mixture of tacit and codified knowledge, the possibilities and limitations of knowledge codification, and the competences and skills required for the development of their activity (Asheim et al. 2007; Asheim and Hansen 2009). The analytical knowledge base refers to activities where knowledge is highly codified and the need for tacit interaction is lower (as in R&D and engineering). The synthetic knowledge base is partially codified, requires more tacit knowledge, and depends more on the context (as in architecture and IT-related activities). Finally, the symbolic knowledge base is associated with the creation of new ideas and images and is highly tacit and context-specific (as in advertising, arts, cinema, fashion, publishing and TV and radio). As most CIs rely on tacit (face-to-face) interaction between creative agents and the specific environment of the area in which they operate, they are expected to agglomerate more intensely than non-creative manufacturing activities (Scott et al. 2001; Asheim et al. 2007). For the same reason, their concentration can also be highly sensitive to distance-decay (Arzaghi and Henderson 2008; Boix-Domenech et al. 2015). Therefore a greater intensity and more rapid distance decay for the agglomeration of CIs than for that of other industries with similar firm-size distributions is expected. Also, these results may change depending on the dominant knowledge base in each creative sector.

In addition to all the above factors, CIs may agglomerate because of: the existence of historical and cultural infrastructures that are essential sources of inspiration for those employed in CIs; the infrastructure of specialised public and social actors that provide support for these activities (e.g. education and training institutions, government-funded agencies, gatekeepers and private lobbying organisations); and 'soft characteristics'[34] or amenities in terms of quality of life, tolerance, and cosmopolitan environments. A particular identity or place-image[35] also attracts creative talents and entrepreneurs in line of Chapters 2 and 3 of this thesis (Scott 2000; Andersson and Andersson 2008; Pareja-Eastaway et al. 2008; Murphy et al. 2014).

However, intra-metropolitan analyses of the agglomeration of CIs should bear in mind that there is in fact a heterogeneous distribution of amenities and cultural infrastructures across neighbourhoods

[34] Soft characteristics can be understood as 'specific urban amenities' that create an environment that attracts people who are key to the most promising economic activities for the economic development of the urban region' (Musterd and Murie 2010). The use of the term 'soft' relates to the fact that these factors are difficult to measure or define (Clark et al. 2002).

[35] Place image refers to the intangible and symbolic values that define the identity, uniqueness and social habits and norms of a place. This place-specific image is more relevant for CIs that work with high levels of aesthetic or semiotic content and where informal know-how and tacit forms of knowledge play a major role (Scott 2006). In fact, soft characteristics and place-image are closely related since both are linked to a 'system of associative structures and social networks, connections and human interactions, that underpins and encourages the flow of ideas between individuals and institutions' (Landry 2000).

within the city (Currid and Williams 2009). In this sense, if CIs are mainly attracted to well-located neighbourhoods where 'things happen' (i.e. social and networking events), creative activities that are highly coagglomerated in some locations of the city and a rapid decay of this agglomeration once one moves away from these focal points are expected.

At the same time, the increasing attraction of these trending neighbourhoods could involve the dispersion of creative activities. That is, once these neighbourhoods gain popularity thanks to all the advantages they offer, the price of rents and other services are expected to rise in those areas (as Pallares-Barbera et al. (2012) and Paül-i-Agustí (2014) have found for Barcelona). As a result, some CIs may decide to locate their activities in other areas where life and activity costs are more affordable (Chapain and Comunian 2010). Moreover, the possibility of teleworking, which is more feasible than ever due to the advances in information technology systems, may also enhance the dispersion of creative workers (Moriset 2003; Merisalo et al. 2013). However, other authors suggest that this process is more complex than it appears because both dispersion and concentration forces still matter in the digital economy (Moriset and Malecki 2009; Moriset 2013).

All in all, creative firms will agree to assume the costs of agglomeration (such as higher rental prices and congestion) whenever the benefits of agglomeration (such as information flows through face-to-face interaction, networking possibilities and specific environments) are large enough to offset its costs. Therefore the agglomeration and coagglomeration of CIs in the MAB is expected and that they will be mainly located in the city centre, probably so that they can benefit from all the above factors, which are more present in these areas.

3. Methodological approach

3.1 M- and m-distance-based functions

To measure agglomeration and coagglomeration, the M- and m-functions are used, which are distance-based methods introduced by Marcon and Puech (2003, 2010) and Lang et al. (2016). These functions can be understood as the natural counterparts of the well-known location quotient in a continuous space approach.[36] The M- and m-functions are two relative distance-based measures that compare the proportion of firms of interest in a given reference neighbourhood to the proportion of firms of interest in the whole area. There is significant agglomeration (dispersion)

[36] The location quotient (LQ) is defined as $LQ = (L_{ij} / L_j) / (L_i / L)$, where L_{ij} is the workforce in industry j in region i, L_j is the total workforce in industry j, L_i is the total workforce in a region i, and L is total employment in the area of reference (e.g. region, country, etc.). A LQ above 1 indicates that the clustering of industry j in region i is larger than the national average, so the region is specialised in this industry.

of firms if the proportion of firms of interest in the neighbourhood of reference is larger (lower) than that of the whole area. The main differences in the interpretation of M and m are their function and ratio definitions. That is, while the cumulative M-function provides the intensity of agglomeration (dispersion) up to a distance *r*, the probability density function m captures agglomeration (dispersion) at a certain distance *r*. Concretely, the m-function calculates bilateral distances between firms and uses a kernel to add the points' weights (in our case, the number of employees), thereby giving a maximum weight to those located at distance *r* (the weight decreases the further the points are located from this distance), while the M-function sums all the points found within a certain radius. Extended definitions of M- and m-distance-based functions can be found in Appendix B.

Both the M- and the m-functions are comparable across industries, control for the overall agglomeration patterns of industries and for industrial concentration, remain unbiased across geographical scales, and allow for statistical significance testing (Marcon and Puech 2010; Lang et al. 2016). They also control for inhomogeneous space and enable a straightforward interpretation and comparison of the results.

An alternative distance-based measure that also satisfies these properties is the Kd-function used by Duranton and Overman (2005). However, the M, m and Kd functions cannot be considered substitutes for one another (Lang et al. 2016). While Kd and m are both probability density functions of point-pair distances because they are calculated on the basis of the average number of neighbours at given distance, the M-function is cumulative, calculated on the basis of the number of neighbours up to each distance. Moreover, although m and M are relative distance-based measures, they differ in that the former is defined at distance *r* and not up to it. Finally, the main advantage of the m-function over the Kd-function is that the former is a relative concentration measure with a straightforward interpretation, while the latter is an absolute measure that is more difficult to compare (Lang et al. 2016). This chapter therefore relies on relative measures since it aims to compare the agglomeration of CIs relative to the other activities.

3.2 Data

The firms in the dataset are located in the MAB, one of the largest metropolitan areas in Europe and the Mediterranean. It is located in Catalonia, an autonomous region in north-eastern Spain. The MAB has an area of 636 km^2 and is home to more than 3.2 million people.[37] In economic terms, it accounts for 51% and 9% of Catalan and Spanish GDP, respectively. The MAB comprises 36

[37] This represents 42% and 7% of the Catalan and Spanish populations in 2012, respectively.

municipalities (see Figure 1) and its capital (Barcelona) accounts for 50% of the population of the whole area.[38]

Figure 1. The Metropolitan Area of Barcelona

Source: http://www.bcn.cat/publicacions/Cartografia/

This study uses micro-geographic data from the SABI database (Bureau van Dijk). SABI contains comprehensive information on firms in Spain, including geographical information (plain coordinates), employment, and characteristics at the 3-digit NACE level.[39] In principle, SABI data cover all limited liability firms and corporations but do not include data on the self-employed or the

[38] Alternative definitions of the MAB can be used (e.g. in terms of Labour Market Areas (LMA) or the number of inhabitants, etc.) but this chapter uses the administrative definition of the MAB since it has a political organisation behind it and it is involved in the creative and innovative transformation of the economy of the area. Moreover, the main aim of this chapter is to analyse the agglomeration of CI firms within the city rather than on the effects of the labour market areas in terms of the commuting of CI employees.

[39] This level of disaggregation is used for convenience since it makes the interpretation of results more manageable. Results at the 4-digit industry level are available upon request.

public sector. The data provides information on 620,390 workers and 44,164 firms[40] located in the MAB in 2012.[41]

This chapter follows UNCTAD's (2010) classification of CIs, which is the most widely accepted classification. The broadest classification available in terms of industries, it includes both manufacturing and service industries, though the relevance of service creative firms is greater than manufacturing ones. Both the aggregation of CIs and each industry separately are considered since this chapter aims to examine whether the agglomeration patterns of CIs differ from those of non-CIs and whether these patterns change from one CI to another.

According to this classification, 4,552 firms are CIs, which represents 10 per cent of total activity in the MAB (see NACE-93 industry classification in Table 1).[42] In terms of employment, 58,159 people are employed in CIs (about 9% of total employment in the MAB). Although this dataset does not cover the "universe" of firms and employment (since it does not include public employment or self-employment), according to Social Security data (IERMB 2013), it does cover around 45 per cent of total employment in the creative sectors.[43]

[40] Unfortunately, it is not possible to distinguish plants from establishments, which would be more appropriate for studying economic activity.

[41] The sample of 44,164 firms in the MAB was obtained after excluding data on firms that did not incorporate their employment in 2012 and those that opened and closed in the same year. The strategy of assigning 1 worker for all firms with missing employment values were also applied as a robustness check. However, as the sample increased to 69,383 firms and the results did not change significantly, the use the restricted sample was preferred because the 1 worker assignation relies on strong assumptions about the distribution of employment.

[42] Photography and design industries (748) are not considered as CIs since our level of aggregation involves mostly non-creative activities.

[43] Several studies use the same database (Duch et al. 2009, Jofre-Monseny and Solé-Ollé 2009, and Jofre-Monseny et al. 2011). Some have explored its representativeness by computing the correlation between SABI and the Social Security Register and finding a correlation coefficient close to 0.90 (Jofre-Monseny et al. 2014).

Table 1. Firm's distribution by creative industries' classification

Code	CIs by NACE-93.1 Classification	Our terminology	N. of Firms	N. of workers
177	Manufacture of knitted and crocheted apparel		13	546
181	Manufacture of leather clothes		6	40
182	**Manufacture of other wearing apparel and accessories**	*Fashion*	208	2,335
183	Dressing and dyeing of fur; manufacture of articles of fur		8	44
191	Tanning and dressing of leather		3	23
192	Manufacture of luggage handbags and the like saddlery and harness		13	1,249
193	Manufacture of footwear		6	41
221	**Publishing**	*Publishing*	420	5,576
222	**Printing and service activities related to printing**	*Printing*	632	6,655
223	Reproduction of recorded media		14	51
362	Manufacture of jewellery and related articles		46	375
363	Manufacture of music instruments		3	31
365	Manufacture of games and toys		15	153
366	**Other manufacturing activities (as costume jewellery)**	*Costume Jewellery*	102	1,099
721	**Hardware consultancy**	*Software*	289	7,215
722	Software consultancy and supply		25	155
731	**Research and experimental development on natural sciences and engineering**	*Natural Science R&D*	83	1,210
732	Research and experimental development on social sciences and humanities		44	355
742	**Architectural and engineering activities and related technical consultancy**	*Architecture & Engineering*	1,085	13,292
744	**Advertising**	*Advertising*	755	6,942
921	**Motion picture and video activities**	*Cinema*	263	3,333
922	**Radio and television activities**	*TV & Radio*	55	2,688
923	**Other artistic and entertainment activities**	*Arts & Entertainment*	446	3,633
925	Library archives, museums and other cultural activities		18	1,118
	Total		**4,552**	**58,159**

Notes: Sectors in bold are selected CIs for the sectoral analysis due to they have more than 50 firms.

When analysing the behaviour of individual creative sectors, information only on sectors with at least 50 firms in the sample (97 of the 190 sectors) is used since sectors with less than 50 firms could lead to unreliable predictions of agglomeration patterns.

To take into account size differences, the two kinds of firms are split into four categories according to number of employees: Micro (less than 10 workers), Small (11–49 workers), Medium (50–249 workers) and Large (over 250 workers). The distribution of firms by size is shown in Table 2. Main conclusions are that the distribution of CIs and non-CIs by size is almost the same and that both kinds of firms operate on a very small scale (roughly 82% of CIs and non-CIs can be classified as Micro).

Table 2. Firm's size distribution (2012)

Size	Non-CIs	CIs	Total
Micro (1 – 10 workers)	31,574	3,680	35,254
	79.71%	80.84%	79.83%
Small (11 – 49 workers)	6,462	700	7,162
	16.31%	15.38%	16.22%
Medium (50 – 249 workers)	697	66	763
	3.42%	3.19%	3.40%
Large (>250 workers)	592	68	660
	0.56%	0.59%	0.56%
Total	39,612	4,552	44,164
	100%	100%	100%

Having established a high presence of creative employment in the MAB, now a more formal analysis of agglomeration patterns using the distance-based M- and m-functions is conducted.

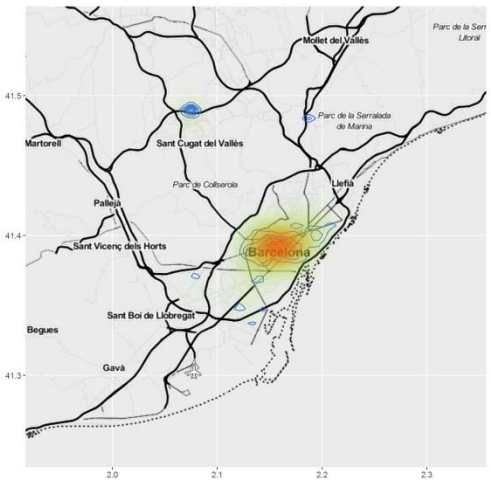
4. Results

4.1 Agglomeration

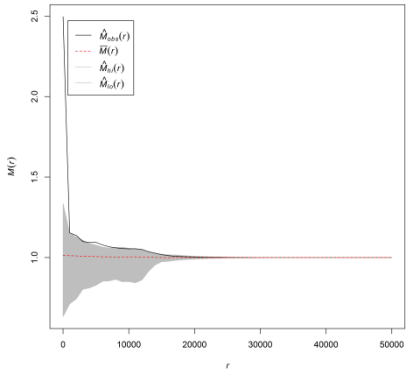
First the intensity and strength of the agglomeration of all CIs compared to other economic activities is analysed (Figure 2). The M-function (panel *b*) peaks at very short distances (close to 0 km) and shows a continuous decay as the distance increases. The degree of agglomeration in a radius of up to 1 km is 1.5, which means that up to this distance, the concentration of employees in CIs is 1.5 times greater than the concentration of employees in all other sectors. The m-results (panel *c*) depict significant agglomeration at 5 km and dispersion at longer distances (from 12 to 50 km). The m-function pattern for CIs therefore illustrates that agglomeration forces are strong at a distance of 5 km, after which dispersion forces prevail. The m-peak is 1.08, which means that at very short distances the proportion of firms in the same CI sectors is 8% higher than in the MAB as a whole. These results support this chapter's expectations about a higher intensity and more rapid distance decay for the agglomeration of CIs than for the agglomeration of non-CIs due to their intrinsic characteristics. The need of CIs for proximity to other creative partners and cultural infrastructures and to neighbourhoods where demand for cultural and creative goods and services is higher could explain their greater need for concentration (Scott 2000; Currid and Williams 2009, 2010). As it was discussed in Section 2, these results may change by each creative sector due to the dominant knowledge base in each sector.

Figure 2. Intra-Industry agglomeration for CIs

a. Density-contour map for CIs



b. M-function for CIs



c. m-function for CIs

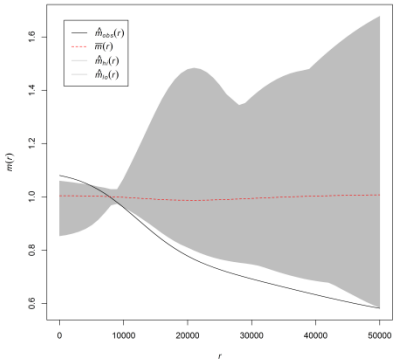


Table 3 shows the M-functions for all 11 creative sectors (those with more than 50 firms). In almost every case, the CIs show significant agglomeration. Here it is possible to analyse which creative sectors are highly agglomerated in a radius of up to 1 km, which corresponds to a firm's proximate neighbourhood. The highest concentration up to 1 km in the MAB appears for fashion, where M reaches 5.22. This means that close to fashion firms, the concentration of employees in the same sector within 1 km is 5.22 times greater than the concentration observed for all other sectors. The fashion sector includes activities such as tailoring and workshop *ateliers,* where repeated contact with customers and suppliers is important. Generally speaking, these fashion activities derive several economic advantages from locating in close proximity: 1) the closeness between fashion firms allows buyers to see a greater number of products and designs in a shorter length of time; 2) location close to iconic places provides local symbolic values that are transferable to final products; and 3) tightly-knit production networks occurring in spatial proximity allow for high levels of flexible subcontracting activity, leading to productivity gains from specialisation (Scott 2000; Williams and Currid 2011). However, proximity may not be important for certain parts of the fashion industry because clothing firms can operate in areas outside the city centre where production costs may be cheaper. For the other creative sectors, the M(1) values range from 1.16 (Software) to 2.10 (Cinema). A higher agglomerations at shorter distances for creative sectors that

are closely related to symbolic knowledge was expected (e.g. arts & entertainment, advertising, cinema, fashion, publishing, and TV & radio) than for other sectors. However, these results show that, although four symbolic-based sectors are among the five most agglomerated ones, there is no clear pattern to distinguish by knowledge base. Moreover, all of these sectors share the same pattern: agglomeration is large at very short distances and dissipates very quickly as the distance increases. Despite the many divergent characteristics of the creative sectors, these sectors are marked by several important common features that make them agglomerate at very short distances. Their agglomeration may largely be explained by their need to be close to neighbourhoods where the demand for services and cultural goods is higher and by the fact that proximity enhances their innovation and flexibility by promoting information flows, network interaction and relational ties among a diverse range of agents (Scott et al. 2001; Currid and Williams 2010). Corroborating the validity of these explanations for Barcelona is unfortunately not possible given the limitations of the data but it is certainly an interesting topic for future research.

Table 3. Intra-industry agglomeration (M- function) by CIs sectors

Industry	M(1)	Spatial extent of significant agglomeration (km)
Fashion	5.22*	0-4
Cinema	2.10*	0-15
Natural Science R&D	2.01	0
TV & Radio	1.92	3 & 5-14
Costume Jewellery	1.69*	0-7
Publishing	1.62*	0-15
Advertising	1.56*	0-15
Printing	1.46*	0-5
Arts & Entertainment	1.35*	0-1 & 4-14
Architectural & Engineering	1.19	0
Software	1.16	2-3 & 6-7

Notes: *Significant at 5%

The results of the intra-industry m-functions for all creative sectors are shown in Table 4. As it was stated earlier, the m-function results are not intended to confirm the M-function results but to complement them. Therefore, it should not be expected them to behave similarly. Seven creative sectors show significant agglomeration or dispersion along the MAB. However, natural science R&D, costume jewellery, software and architecture and engineering activities show neither significant agglomeration nor dispersion.

For all the other sectors, two patterns of the m-function are found. The first is a clear pattern for activities that are mainly based on symbolic knowledge (advertising, arts and entertainment, cinema, fashion and publishing). For these activities a single significant agglomeration point at short distances (at 1 km) are found and these agglomerations decay until they show significant dispersion from approximately 10 to 50 km. No significant pattern for analytical or synthetic knowledge-based sectors (e.g. R&D, software, architecture and engineering) is found since they show no significant agglomeration or dispersion. The second is a different pattern for printing, which may be considered a creative manufacturing sector that is less dependent on knowledge exchange and a place-specific image. It first shows significant dispersion from 0 to 10 km and then increases to show significant agglomeration from 25 to 31 km. The maximum concentration for the MAB appears for this sector (2.33 at 31 km). This means that, close to printing firms, the proportion of firms at this distance in the same sector is 133% greater than in the whole MAB. Following Lang et al. (2016), at close distances, the local relative density of reference printing firms over the other firms is minimum. At a distance of around 10 km, the m-function detects the first cases located at the periphery of a new agglomeration and as a result the m-function rises rapidly due to the large number of printing firms inside the agglomeration.

Table 4. Intra-industry agglomeration (m-function) by CIs sectors

Industry	m-peak	Distance at which m-peak appears (Km)
Printing	2.33*	31
Natural Science R&D	2.07	46
Costume Jewellery	1.38	30
TV & Radio	1.33*	1
Publishing	1.30*	1
Cinema	1.29*	1
Advertising	1.18*	1
Arts and Entertainment	1.16*	1
Software	1.12	1
Fashion	1.07*	1
Architectural & Engineering	1.06	1

Notes: *Significant at 5%

To better understand how these functions work density maps and M- and m-results for the publishing and printing sectors are compared, which are traditionally interconnected in terms of

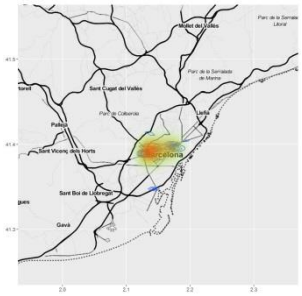
input and output linkages (Boix-Domenech 2013).[44] Panels *a* and *b* in Figure 3 show the spatial density of these sectors in the MAB. As the Figure shows, while publishing is highly concentrated at short distances, printing is concentrated in a more geographically extended way throughout the MAB around several employment subcentres. With regard to M-functions, panels *c* and *d* show significant agglomeration up to short distances for both sectors, after which the strength of agglomeration decays rapidly. As panels *e* and *f* show, the agglomeration of publishing is statistically significant at short distances. At long distances (above 10 km), there is significant dispersion. In contrast, printing describes the opposite case. In other words, the M- and m-functions show a "centralised" agglomeration for publishing, i.e. a unique focal point at close distances (which, according to the density maps, can be placed in the centre of Barcelona), and a "decentralised" agglomeration for printing, i.e. agglomeration around more than one employment centre (according to the density maps, located inside and outside city-centre Barcelona). This finding is clearly linked to the decentralisation of mature activities[45] (Scott 1988). Mature industries that are not so dependent on symbolic knowledge – such as printing – tend to move outwards from urban centres where they obtain cost advantages, since their networking connections are already established. On the other hand, publishing needs to be in the city centre in order to take advantage of factors related to its symbolic knowledge base (i.e. social and cultural events that enhance networks, face-to-face interaction, place-specific image, etc.).

[44] It should be clarified that for the M-function, when significant agglomeration appears at distances very close to zero, this does not mean that this agglomeration is at the central point of the whole area. However, when this result is compared with the density map, this agglomeration seems to correspond to one located at the city centre.

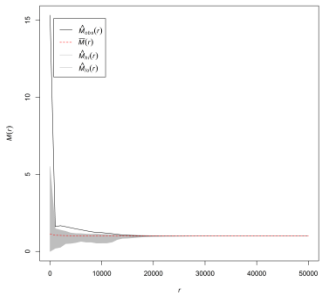
[45] Mature industries can be defined as those that were at the core of manufacturing activities in the nineteenth and early twentieth centuries, that use low-skilled workers intensively and that have relatively stagnant technological change.

Figure 3. Comparison of the results of distance-based measures for the publishing and printing sectors

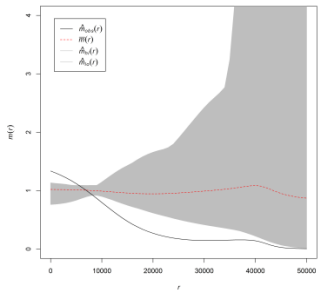
a. Density-contour map for publishing



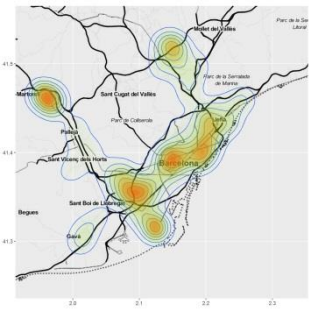
c. M-function for publishing



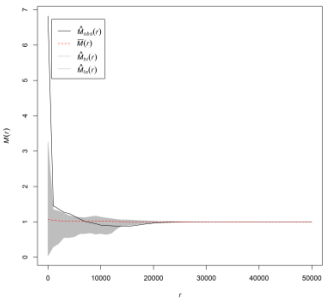
e. m-function for publishing



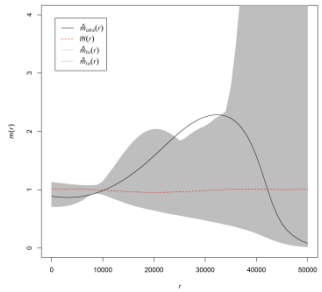
b. Density-contour map for printing



d. M-function for printing



f. m-function for printing



To sum up, the above findings imply that for CIs, agglomeration is urban rather than metropolitan, while for the other activities – which are less dependent on tacit interaction and specific context – the role played by suburban employment centres is stronger. They also confirm our expectations about the greater need for agglomeration of CIs than for non-CIs at very short distances due to their intrinsic characteristics. Moreover, they show that the spatial extent of the agglomeration of CIs is quite limited, which indicates the importance of networking and knowledge exchange in those industries.

4.2 Coagglomeration

The aggregate results for the coagglomeration of CIs and non-CIs (see Figure 4)[46] show that CIs and non-CIs do not coagglomerate in the MAB. Specifically, non-CIs are repelled by CIs at very

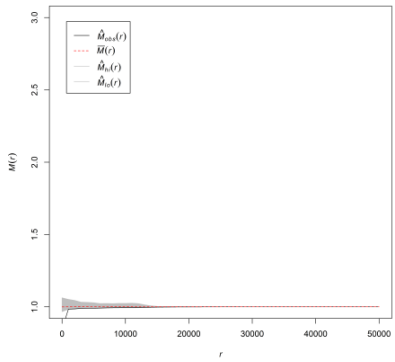
[46] These figures should be read as follows. Figure *a* shows that the relative density of employees in non-CIs located around those of CIs is smaller in a radius of 1 km than for the whole area. Figure *b* shows that the relative density of employees in CIs located around those of non-CIs is randomly and independently distributed along the whole area. With regard to firm-size results: Figure *c* shows that the relative density of employees in Micro non-CIs around those of Micro CIs is larger in a radius of 10 km than for the whole area;

short distances, where the M-function reaches 0.85. Moreover, the coagglomeration values of CIs around non-CIs are not statistically significant. However, when inter-industry M-functions for CIs by size (in terms of number of workers) is calculated, significant coagglomeration for Micro CIs settled around Micro non-CIs is found. The M-value up to 1 km is 1.32. The coagglomeration of Micro non-CIs located around Micro CIs is also significant, showing a peak of 1.30 up to 1 km. These results indicate that there is important coagglomeration between both types of activity, as is expected due to the high proportion of small firms in the CIs. These results suggest that the attraction of economic activities to CI firms is only relevant for small firms; in fact, the mechanisms by which CIs may promote knowledge flows, the spread of ideas and new forms of entrepreneurship are more feasible between small firms than between large corporations (Scott 2000; Flew 2010). However, this result is not specific to CIs since smaller firms have a greater need to agglomerate in order to gain access to specific services and diminish transaction costs (Scott 1988). Bearing in mind that coagglomeration between CIs and Non-CIs may be explained by industrial size factors rather than the ability of CIs to attract economic activity around them, now the coagglomeration between CI sectors is analysed in detail.

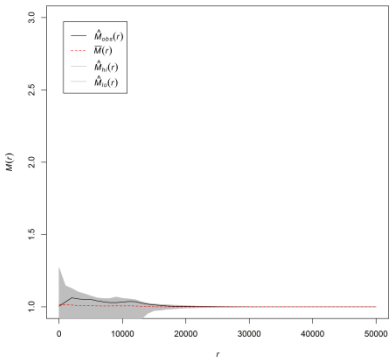
and Figure *d* shows that the relative density of employees in Micro CIs around those of Micro non-CIs is larger in a radius of 12 km than for the whole area.

Figure 4. Inter-Industry M-functions by type of firm

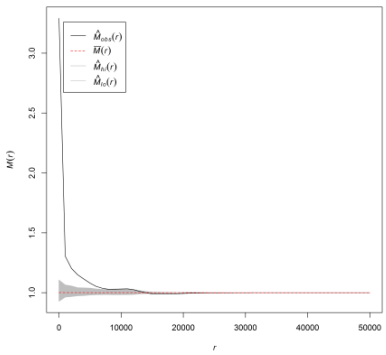
a. CIs vs. non-CIs



b. Non-CIs vs. CIs



c. (Micro) CIs vs. non-CIs



d. (Micro) Non-CIs vs. CIs

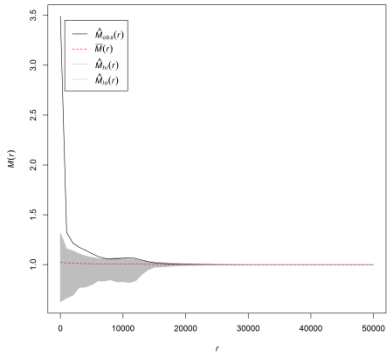


Table 5 shows the inter-industry M-functions only for creative sectors with significant coagglomeration up to 1 km. Interestingly, all these coagglomerated creative sectors are symbolic-based activities (e.g. advertising, cinema, publishing) except for architecture and engineering, a sector that encompasses analytical and synthetic knowledge. Specifically, all sectors show similar levels of coagglomeration, with M-values ranging from 1.38 to 1.70 up to 1 km.[47] Coagglomeration in these sectors may be due to several reasons. Firstly, the firms need to be located close to neighbourhoods where the demand for services and cultural goods is high and close to specific cultural infrastructures that help them to conduct their activities (e.g. cultural associations, cinemas, theatres, museums, galleries, architectural monuments, festivals, etc.) (Currid and Williams 2009, 2010). Secondly, these firms are interconnected in tightly-knit production networks in which the common practice is flexible subcontracting (Scott 2000). Thirdly, the location of different symbolic-based sectors in a certain place often results in a comparative advantage by the addition of place-specific connotations that are transferable to final products or services. In the case of Barcelona,

[47] However, if a wider distance criterion for coagglomeration is applied, several cases of coagglomeration at short distances from 2 to 5 km are found. These appear among symbolic-based creative sectors such as publishing and arts, publishing and TV & radio, advertising and arts, and cinema and arts.

this is usually associated with Mediterranean culture, modernism, design and creativity. Finally, all these sectors need to locate in areas where continuous flows of information and trends are discernible in order to adapt their production to current demands. The only exception to this is the coagglomeration between architecture and engineering and cinema, which in Barcelona can be explained by the fact that firms operating in those sectors are mainly located in the 22@ district (Barber and Pareja-Eastaway 2010; Viladecans-Marsal and Arauzo-Carod 2012).[48] In this case, the coagglomeration between these sectors cannot be explained by an interconnection of tightly-knit production networks, but rather should be seen as a result of an induced cluster policy in order to provide those facilities and services enhancing their activity (i.e., larger spaces and co-working facilities, proximity to specialised human capital formation centres, public aids, etc.). For the remaining creative sectors, significant agglomeration but no significant coagglomeration is observed. The agglomeration of these industries may be occurring in different areas of the city. Generally speaking, these results are in line with previous findings such as those of Scott (2000), De Propris et al. (2009), Currid and Williams (2009; 2010) and Boix-Domenech et al. (2015).

Table 5. Inter-industry coagglomeration (M- function) by selected industries[49]

Central industry	Around industry	M(1)	Spatial extent of significant coagglomeration (km)
Publishing	Advertising	1.54*	0-14
Advertising	Publishing	1.46*	0-15
Publishing	Cinema	1.70*	0 -14
Cinema	Publishing	1.44	0 & 2-15
Architecture & Engineering	Cinema	1.34	4-10
Cinema	Architecture & Engineering	1.58*	0-1 & 5-8
Advertising	Cinema	1.40	2-14
Cinema	Advertising	1.54*	0-1

Notes: *Significant at 5%

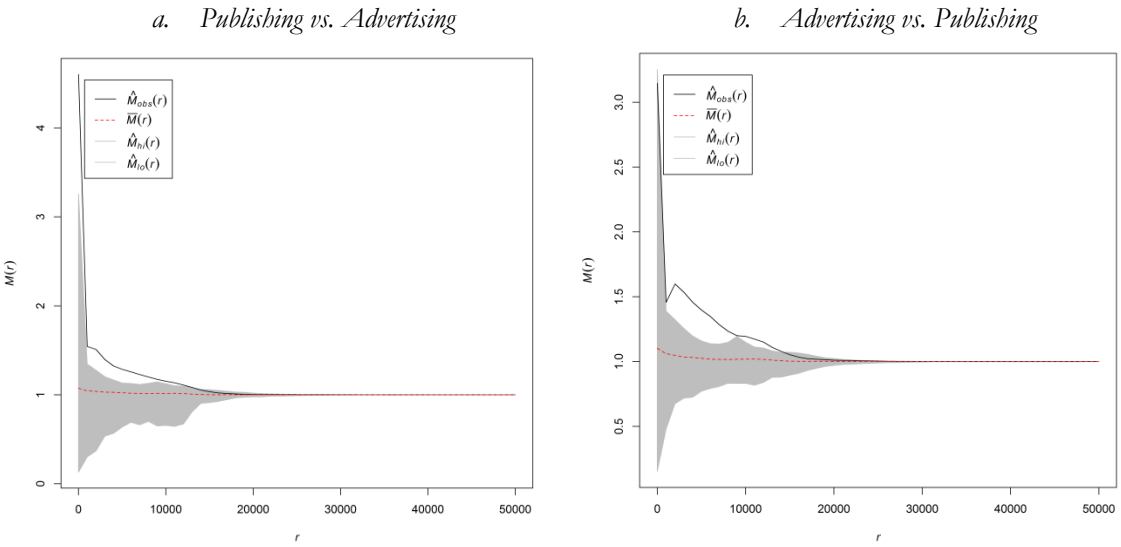
Figure 5 shows the M- and m-functions of coagglomeration for one of the highest significant M-values of coagglomeration for publishing and advertising, where advertising is located around publishing with an M-value up to 1 km of 1.54, and publishing is located around advertising with an M-value up to 1 km of 1.46. It can be speculated that the role of advertising agencies as intermediaries between advertisers and media (e.g. editors looking for advertising campaigns to fund their publications or advertising designers looking for new advertising campaigns) and use of

[48] This district was created in 1998 as a public initiative to encourage the concentration of activities closely related to innovation and creativity by providing networking and work space facilities and granting support.

[49] These M-functions results have been calculated in a distance range of 50 km. Here only significant coagglomeration results are shown but, non-significant results are available upon request.

the same cultural infrastructures (e.g. exhibition venues, social and cultural clubs or cafes, etc.) may explain the coagglomeration observed among these creative sectors.

Figure 5. Inter-Industry M-Function by selected CI sectors



Although these results support the idea that creative industries coagglomerate due to inter-sector synergies that form complex patterns of specialisation and complementarity, due to lack of data the drivers of these processes cannot be formally analysed. Therefore the identification of shared competences, resources and characteristics of places that explain the coagglomeration of creative sectors is left for future studies.

To sum up, the results of this chapter show that only CIs with less than 10 workers coagglomerate with non-CIs; that symbolic-based creative firms coagglomerate around the most historic and central neighbourhoods of Barcelona; and that while aesthetic, networking and input-output linkages certainly explain this high degree of coagglomeration, other knowledge-based creative firms (such as R&D) or mature CIs (such as printing) seem to be highly agglomerated but do not coagglomerate in the same areas, possibly because of their lesser need for face-to-face interaction and place-specific image. Moreover, these results are more relevant if the period of analysis is taken into account. In 2012 the MAB was in a deep economic crisis that affected public and private financial support and consumption patterns (ICEC 2012). Nevertheless, CIs remained highly coagglomerated in the city centre where operational costs are high, perhaps due to all the aforementioned agglomeration advantages.

5. Discussion and conclusions

The main aim of this chapter was to provide an intra-metropolitan analysis of the intensity and extent of the agglomeration and coagglomeration of CIs in the MAB. This chapter therefore contributes to the literature on the spatial distribution of CIs by comparing the agglomeration patterns of CIs and non-CIs as well as those of different CI sectors. It deals with previous methodological limitations by introducing, for the first time in the literature, the relative distance-based measures M and m (following Marcon and Puech (2003, 2010) and Lang et al. (2016)) in the analysis of location patterns of CIs. Specifically, results suggest that *i)* CIs are relatively more agglomerated than other activities, *ii)* most CI sectors follow a similar agglomeration pattern in which most of them are highly agglomerated at small distances and this agglomeration rapidly decays as the distance increases, *iii)* the spatial extent of the agglomeration of CIs, seen as a proxy for agglomeration externalities, is very short (mainly concentrated between 0 and 1 km), and *iv)* only symbolic-based CIs coagglomerate, mostly in some of the central neighbourhoods of Barcelona.

All these results confirm preliminary expectations and complement previous contributions. Specifically, they endorse the theoretical discourse on the greater need of CIs for spatial proximity in relation to non-creative activities (Scott 1997; Scott et al. 2001) and on how the CIs' tendency to coagglomerate remains consistent wherever they locate (Currid and Williams 2010). Moreover, they complement the findings of Boix-Domenech et al. (2015), which until now was the only study to apply a continuous space method to deal with the agglomeration and coagglomeration of CIs. It also finds that CIs are highly agglomerated around a focal point in Barcelona city centre. However, by taking advantage of the capacity of M- and m-functions to test the statistical significance of the results at each distance, it is also able to ascertain the extent and intensity with which CIs agglomerate and coagglomerate compared to other activities in the city. However, since these effects are not specifically studied in this chapter, the discussion of the possible effects of agglomeration on firms' location decisions will be discussed in Chapter 5. Instead, this chapter focuses on the usefulness of this approach for helping public administrations design urban policies to increase the attractiveness and potential competitiveness of urban areas.

At this point, these findings raise several policy implications. First, even if most CIs share a common spatial pattern of agglomeration, creative strategies should take into account sectoral specificities and all the essential elements they share. Secondly, because of this evident concentration of creative activities in the city centre, it seems clear that agglomeration advantages largely compensate for agglomeration diseconomies involved in being located in the city centre (up to 1 km for most CIs). In this sense, these results suggest that those firms aiming to locate in Barcelona should take into account that they may benefit from agglomeration effects if they locate within a radius of 1 km from the core neighbourhoods of the city and that urban policies aiming to

attract CIs should promote short-distance clusters. Since the agglomeration of CIs seems to be mainly explained by a path-dependence process, this chapter therefore wonders what the actual role of public institutions should be (Musterd and Murie 2010). However, if these agglomerations emerge in central areas it is because they can find soft characteristics and connectivity with established producers, intermediaries, markets and consumers. Local governments should therefore focus on providing and improving these features without ignoring the creation of talent. Results also highlight the huge importance of the city of Barcelona in terms of the agglomeration of CIs inside the MAB. Evidence found in this article therefore suggests that policy-makers should not apply the same strategies to the whole area of the MAB (i.e. Barcelona city centre and its periphery), since it seems quite obvious that Barcelona has numerous features that are clearly magnets for CI concentration that cannot be transferred to other metropolitan municipalities. In accordance with the importance of CIs in Barcelona, the strategies of these peripheral cities in the MAB should therefore be based on collaboration rather than competition. Finally, the results of this chapter and those of López-Gay (2016) for Barcelona show that the central areas of Barcelona act as a magnet both for CIs and young skilled workers. Together with rising house prices, this leads to a progressive suburbanisation of poverty that increases socioeconomic inequalities. In this sense, policies that focus on CIs as urban regeneration and economic growth tools for reducing socioeconomic inequalities should bear in mind that the benefits of attracting creative talents and firms may not be easily spread to peripheral areas.

Productive future research will expand this analysis in two main ways. Firstly, by identifying why CIs agglomerate and coagglomerate similarly in whichever city they locate. In this context it would be interesting to take into account demand factors to identify the actual role of characteristics (e.g. cultural infrastructures, soft characteristics, place-specific image) that traditionally explain the agglomeration of CIs in the urban centre. Secondly, by analysing how the spatial extent of agglomeration economies can affect the economic performance of CIs and non-CIs.

Appendix B

Distance-based methods: M- and m-functions

The M- and m-functions are calculated for every 1,000 metres between 0 and 50 km at the industry level for all CIs and some CI sectors.[50] The plain coordinates (X-Y) are used for each firm located in the MAB. Both measures are calculated using the R package *dbmss* (Marcon et al. 2015).

[50] The spatial extension of 50 km covers all the geographical area of the MAB as well as outside its administrative borders.

M-functions

Evaluating agglomeration at intra-industrial level

Following Marcon and Puech (2010), the M-function for intra-industrial spatial agglomeration in a circle of radius *r* for a sector C can be defined as:

$$\widehat{\mathrm{M}}(\mathrm{r}) = \frac{\sum_i \frac{\sum_{j,i\neq j} 1\left(\left\|x_i - x_j^C\right\| \leq r\right) w(x_j^C)}{\sum_{j,i\neq j} 1\left(\left\|x_i - x_j\right\| \leq r\right) w(x_j)}}{\sum_i \frac{W_C - w(x_i)}{W - w(x_i)}} \quad (1)$$

where x_i denotes the reference points and x_j^C denote their neighbours of a chosen type (firms in industry C), $i = 1,2,\ldots,n$ is an index for firm and $w[W]$ denotes [total] employment. The function works as follows. First all firms belonging to sector *C* in the area of study are identified. Here, a *sector C* refers to a type of firm (CIs or subsectors of CIs). For each of these firms, a circle of radius *r* (e.g. 1 km) is drawn. Within this distance, the number of employees belonging to firms in sector C $(w(x_j^C))$ is counted. Then the sum of this quantity over *i* as a proportion of the number of employees belonging to firms in all sectors within the same circle is expressed. Next, this ratio is divided by sector *C'* s employment weight in total employment in the whole area.

The benchmark of the M-function is one. M-values *equal to one* indicate that whichever radius is considered, there are proportionally as many employees belonging to sector *C* as there are in the global area, or that there is a completely random location of firms in this sector *C*. M-values *larger than one* indicate that there are proportionally more employees close to firms in sector *C* in a radius *r* than in the global area, which indicates that there is a relative geographic agglomeration of sector *C* up to a distance *r*. M-values *smaller than one* indicate that there are relatively fewer employees in sector *C* within a radius *r* than in the global area, or that sector *C* is relatively dispersed.

The statistical significance of the M-function is estimated by constructing confidence intervals for the null hypothesis of the independence of firm locations, according to which the firms belonging to sector *C* locate following the same pattern as the others. These intervals are determined using Monte-Carlo methods as follows. After generating a large number of simulations (1,000), a confidence level of 5 per cent is chosen so that the 95 per cent confident interval of M for each value of *r* is delimited by the outer 5 per cent of the randomly generated values. There is significant relative agglomeration (dispersion) in a given sector if the corresponding M-values are larger (smaller) than one and are outside the confidence interval bands.

Evaluating coagglomeration at inter-industrial level

The inter-industrial version of the M-function assesses the presence of coagglomeration. M-functions of coagglomeration for sectors C_1 and C_2 are defined as in $\widehat{\mathrm{M}}(\mathrm{r})$ but the denominator is slightly different in this intertype function: $\sum_i \frac{W_C}{W-w(x_i)}$.

$M_{C_1C_2}(M_{C_2C_1})$ depicts the spatial structure of firms belonging to sector $C_2(C_1)$ that are found around sector $C_1(C_2)$. The value shows whether the relative density of firms $C_2(C_1)$ located around those of sector $C_1(C_2)$ is larger or smaller than that observed for the whole area. The statistical significance of the inter-industrial M-functions is tested using the same methodology as for the intra-industry indicator described above, though the construction of the confidence intervals is slightly more complicated (Marcon and Puech 2010). Significant values of $M(r, C_1, C_2)$ may be due to interactions between sectors, or to C_1 or C_2 individual patterns. The null hypothesis should therefore control for both the C_1 and C_2 patterns. The null hypothesis point set for $M_{C_1C_2}(r)$ is therefore generated by keeping C_1 points unchanged and redistributing all other points onto all other locations. The same process is followed for C_2. There is significant coagglomeration whenever both values are significantly different from their respective null hypothesis.

m-function

Following Lang et al. (2016), the data on firms is defined as points and that all these points belong to a point pattern X. Two subsets are considered: that of the reference points C (i.e. the creative sector) and that of the neighbouring points of interest – in this case, those belonging to the same creative sector C since our goal here is only to measure intra-agglomeration. The m-function is then defined as follows:

$$\widehat{\mathrm{m}}(\mathrm{r}) = \frac{\sum_i \frac{\sum_{j,i\neq j} k\left(\left\|x_i - x_j^c\right\|, r\right) w\left(x_j^c\right)}{\sum_{j,i\neq j} k\left(\left\|x_i - x_j\right\|, r\right) w\left(x_j\right)}}{\sum_i \frac{W_C - w(x_i)}{W - w(x_i)}} \qquad (2)$$

where x_i denote the reference points (firms in the creative sector) and x_j^c are their neighbours (firms in the same sector). $w(x_i)$ is the weight of point x_i. W_C is the total weight of the neighbouring points of interest and W is the total weight of all points. In this case, the weights are the number of employees working in those sectors.[51] $k(\cdot)$ is a Gaussian kernel estimator whose sum can be used to estimate the number of neighbours of point x_i at distance r. The bandwidth is set according to Silverman's optimal bandwidth rule (Silverman 1986). Also, like in M-functions, the significance of m is given by the confidence interval of the null hypothesis by using Monte-Carlo

[51] Results did not vary significantly when M- and m-functions without employment weights were calculated.

simulations. Global confidence intervals – following Duranton and Overman (2005) – are generated by permuting the marks (type and weighting pairs) of the actual points on the actual spatial location (coordinates). The interpretation of the m-function is quite similar to the interpretation of the M-function. m-values *greater than one* indicate the spatial concentration of points at a given distance *r*, while m values *lower than one* indicate dispersion.

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Chapter 5

Creativity and the city: Testing the attenuation of agglomeration economies for the creative industries

1. Introduction

In an increasingly global world, local governments have attempted to enhance the agglomeration of the most innovative and creative firms and highly-skilled workers in their cities in an attempt to improve their regional competitiveness. This is the case of Barcelona, which has been engaged in a process of transformation into an economy oriented to innovation, creativity and culture for the last twenty years (Foord 2009; Pareja-Eastaway and Pradel-i-Miquel 2014). As a result, Barcelona now accounts for more than 7,000 firms and 100,000 employees in the creative industries (CIs)[52], which have made the city into one of the most important creative hubs in Europe (IERMB 2013).[53] Clearly, the increasing attraction to Barcelona may have many implications for Barcelona's economy and social conditions. Three different questions need to be asked. First, what is the spatial extent of externalities associated with the agglomeration of CIs? In particular, how much does the productivity of a firm increase when other creative firms decide to locate nearby? Second, how quickly do these external economies attenuate with distance? Finally, how can market potential effects mitigate agglomeration economies for CIs? In particular, to what extent can market potential explain why CIs agglomerate and coagglomerate similarly in whichever city they locate? The answers to these questions are important both for firms' location decisions and for the accurate design of policies focusing on the agglomeration of CIs as a tool for urban regeneration, the attraction of skilled workers and the generation of creative and innovative environments.

This chapter analyses the spatial extent of agglomeration economies for the CIs in Barcelona and its relationship with firm performance. In particular, it tries to control for market potential effects in

[52] Creative Industries are defined as knowledge-based activities based on individual creativity, skill and talent, with the potential for wealth and job creation through the development of intellectual property; they include activities like arts, advertising, cinema, fashion design, publishing, R&D or software (UNCTAD 2010). See DCMS (2001), European Commission (2010) and UNCTAD (2008; 2010) reports to understand the increasing relevance of these industries over the last decade.

[53] CIs represent 7.5% of all the firms in the city of Barcelona. In terms of labour market, Barcelona accounts for the 49% of the total employment in CIs in Catalonia.

order to identify the actual role of the specific characteristics (i.e., networking opportunities, cultural amenities, place-image) that traditionally explain the spatial concentration of CIs in the city centre. To do this a panel data from Mercantile Register (SABI) that provides micro-geographic data of firms between 2006 and 2015 has been used. The effects on productivity of intra-industry (among CIs) and inter-industry (non-CIs) agglomeration in rings around location in Barcelona are estimated. Agglomeration measures and proximity to urban amenities are computed by using Geographical Information Systems (GIS) techniques. For each creative firm and year, a series of firm ring variables are created counting the number of neighbouring firms or amenities located within each distance band defined around the reference firm. With this fine level of geographic detail, the actual benefits of close interactions among CIs are inferred.

The main results of this chapter show that, for the symbolic-based creative service industries (CSIs), localisation economies – mainly understood as networking and knowledge externalities – have positive effects on total factor productivity (TFP) at short distances (less than 250 metres) and these quickly disappear with distance, while for the two other knowledge-based CSIs (i.e., synthetic and analytical) localisation economies seem to be less relevant. When controlling for market potential effects, an increase of 10% in the number of symbolic within 250 metres of the firm is found, increases the TFP of a symbolic-based CSIs firm by 0.99%. This suggests that the benefits of being in a better neighbourhood are not only associated with market potential. Moreover, CSIs productivity is considerably associated with proximity to specialised human capital and to co-working spaces. All these results confirm the importance of networking or information spillover effects for CIs and that these results depend on the dominant knowledge base of each creative sector, specially for those industries relying more on networking (face-to-face interaction) and context specific characteristics – i.e., symbolic-based CSIs – which are highly concentrated in the core areas of the largest cities as this thesis confirms in Chapter 4 (see also Arzaghi and Henderson 2008; Boix-Domenech et al. 2015).

This chapter mainly deals with the agglomeration of CIs. According to the existing literature, as CIs are characterised by a high proportion of small firms and a project-based nature that require constant explicit and tacit contact within formal and informal networks, there are advantages for employees in creative sectors agglomerating in the same areas (Caves 2000; Pareja-Eastaway 2016). In this regard, geographical proximity can certainly facilitate the exchange of knowledge between different agents working in the same area if knowledge is tacit and context-specific and requires repeated contact with others (see for instance, Scott 1997; Banks et al. 2000; Tschang and Vang 2008 or Henderson 2007). Nevertheless, the effect of the spatial extent of agglomeration economies on the productivity of creative firms within urban areas has not yet been analysed in the existing literature (e.g., Cooke and Lazzeretti 2008; De Propris et al. 2009; Lazzeretti et al. 2012;

Boix-Domenech et al. 2015). So, if we wish to understand the *raison d'être* of urban creative-led policies and the robust trend of CIs to agglomerate in city centres, the impact of agglomeration economies emerging from the spatial proximity between CIs on firms' productivity needs to be analysed.

The basis of this study is also related to the empirical literature analysing the role played by agglomeration economies on TFP (see, for instance, Ciccone and Hall 1996, Henderson 2003 and Martin et al. 2011). However, their findings are difficult to generalise due to a diversity of results stemming from the use of different geographic units and approaches to measuring agglomeration (Rosenthal and Strange 2003). In this literature, this traditional spatial analysis can bring to the Modifiable Area Unit Problem (MAUP), which leads to empirical results biased across geographical scales (Arbia 1989).[54] Moreover, agglomeration effects are likely to attenuate rapidly over space (Rosenthal and Strange 2003, 2008; Arzaghi and Henderson 2008). In this context, a few papers have tried to measure the scale and spatial extent of agglomeration economies. One of the approaches to the issue is to compute a density-based measure that counts the number of neighbour firms located within rings around the reference firm with increasing radius. The main advantage of this method is that by considering space as continuous, it avoids the aforementioned MAUP. In the existing literature only a few papers consider this approach and most of them focus on manufacturing activities (see, for example, Desmet and Fafchamps (2005) and Rosenthal and Strange (2003, 2005, 2008) for the USA, and Di Addario and Patacchini (2008) for Italy). For the case of CIs it is difficult to find contributions that use this approach. The only paper that introduces the spatial decay of agglomeration economies for a particular creative industry is Arzaghi and Henderson (2008), who find that there is an extremely fast spatial decay of agglomeration effects occurring primarily within 500 metres for advertising agencies in Manhattan.

Against this background, this chapter goes further than previous contributions in several directions. First, it infers the spatial extent of agglomeration economies for CIs and its relationship with firm performance to use distance-based methods to measure agglomeration for CIs. Only two comparable works analyse this issue: Arzaghi and Henderson (2008) and Chapter 4 of this thesis. Arzaghi and Henderson (2008) focus on the advertising agency industry in Manhattan. In this regard, Chapter 4 of this thesis provided an intra-metropolitan analysis of the intensity and extent

[54] The MAUP appears when the same analysis is applied to the same data, but different spatial aggregation schemes are used, which give different results. MAUP takes two forms: the scale effect and the zone effect. The scale effect gives different results when the same analysis is applied to the same data, but changes the scale of the aggregation units. The zone effect is observed when the scale of analysis is fixed, but the shape of the aggregation units is changed. See Arbia (2001) for more details.

of agglomeration and coagglomeration for all CIs in the Metropolitan Area of Barcelona and found that the spatial extent of the agglomeration of CIs is very short (less than 1km). Thus, this chapter goes one step further to previous Chapter 4 by analysing the effect of agglomeration economies on creative firm performance and by identifying up to which distance these effects are significant and at which point they turn into disagglomeration economies.

Second, as most CIs rely on tacit (face-to-face) interaction between creative agents and on the specific environment of the area in which they operate, they are expected to agglomerate more intensively than non-creative manufacturing activities (Scott 1997, Feldman 2000). For the same reason, their concentration can also be highly sensitive to distance-decay (Henderson 2007; Arzaghi and Henderson 2008; Boix-Domenech et al. 2015). Thus, a positive effect and rapid distance decay for the agglomeration economies for CIs than for other industries with a similar firm-size distribution is expected, and these results may depend on the dominant knowledge base[55] of each creative sector. In this regard, the findings of this chapter are new in the literature and some of them verify previous theoretical predictions. While the above papers only analyse the attenuation of agglomeration economies for one creative industry or provide a descriptive analysis of the agglomeration of CIs, this chapter studies the spatial intensity and extent of agglomeration economies by distinguishing between different knowledge-based CIs. It also compares the results of CIs and non-CIs.

Third, CIs are known to require spatial proximity to benefit from networking possibilities, face-to-face interaction and accessibility to neighbourhoods where the demand for services and cultural goods, urban amenities such as cultural infrastructures, diversity of people and activities are higher, or being associated to place-specific image or reputation (see, for instance, Currid and Williams 2010, Boix-Domenech et al. 2015 and Sánchez-Serra 2016 for a summary of the main factors explaining the agglomeration of CIs). However, and as this thesis points out in Chapter 4, previous studies have not discussed how market potential effects could mitigate these agglomeration advantages for CIs and how they may explain the tendency of CIs to coagglomerate whichever city they are located in (Currid and Williams 2010). Unlike previous contributions on CIs agglomeration patterns, this chapter tries to control for market potential in order to identify the actual role of the specific characteristics (i.e., networking opportunities, cultural amenities) that traditionally explain the agglomeration of CIs in the city centre.

Finally, although GIS techniques and Open Street Maps (OSM) data are not new in the literature, this chapter is among the first to use on GIS to count the stock of amenities within 1000 metres of

[55] See Section 3 for a definition of the different knowledge bases and a classification of CIs according to their dominant knowledge base.

each firm located in Barcelona between 2006 and 2015. The chapter provides empirical evidence that CIs productivity is considerably more associated to proximity to specialised human capital and co-working spaces than to other types of cultural or natural amenities.

The remainder of the chapter is as follows. Section 2 details the empirical approach, while Section 3 describes the data, and Section 4 presents main results. Finally, Section 5 discusses main conclusions.

2. Empirical strategy

2.1. The model

Agglomeration economies are generally assumed to improve the TFP of firms through localisation economies and urbanization economies. Availability of firm-level data, an empirical strategy based on the estimation of a Cobb–Douglas production function can be used:

$$Y_{it} = A_{it} K_{it}^{\propto} L_{it}^{\beta} \quad (1)$$

where Y_{it} is the value-added of plant *i* at time *t*, A_{it} is TFP, $K_{it}^{\propto}$ is the capital stock and L_{it}^{β} is the labour force (in terms of employees) of firm *i* at time *t*. It is assumed that the TFP of firm *i* depends on a firm-level component, U_{it}, but also on its immediate environment in terms of localization and urbanization economies, and a set of controls:

$$A_{it} = \left(LOC_{it}^{D}\right)^{\delta} \left(URB_{it}^{E}\right)^{\gamma} X_{it}^{\sigma} U_{it}\,, \quad (2)$$

where LOC_{it}^{D} captures the local agglomeration externalities (CSIs) computed within different distance bands *D* for firm *i* and at time *t* ; URB_{it}^{E} capture urban agglomeration externalities (non-CSIs); and X_{it}^{σ} is a set of neighbourhood-firm variables for firm *i* and time *t*. By log-linearizing expressions (1) and (2), one obtains:

$$ln\,(Y_{it}) = \propto ln(K_{it}) + \beta ln(L_{it}) + ln(A_{it}), \quad (3)$$

$$\ln(A_{it}) = \sum_{d=1}^{D} \delta_d \ln(LOC_{it}^{D}) + \sum_{f=1}^{F} \gamma_f \ln(URB_{it}^{F}) + \sum_{k=1}^{k} \sigma_k \ln(X_{it}^{k}) + u_{it} \quad (4)$$

Following Martin et al. (2011), the chapter's strategy consists first in estimating Eq. (3) in order to obtain A_{it}. Then, Eq. (4) is estimated. Here, Eq. (3) can be used to relate TFP to local characteristics, which can determine the channels through which agglomeration economies operate.

To analyse the attenuation of agglomeration economies, the spatial scope of agglomeration effects is given by the distance after which the local characteristic no longer has a significant effect. It is possible to find that agglomeration effect first increase with distance before decreasing. Then, this turning point gives the spatial scale at which they are the strongest (Combes and Gobillon 2015).

2.2. Estimation issues

Consistent estimation of the parameters of a production function is problematic. In particular, as output, labour, and other inputs are simultaneously determined by the firm, then inputs are likely to be endogenous variables because the error term of the model typically contains unobservable output determinants, involving potentially inconsistent estimates of the coefficient from ordinary least squares. To deal with these issues several approaches have been developed in recent decades (Van Beveren 2012) among which stand out sophisticated semi-parametric approaches to control for unobservables making use of additional information on investment (Olley and Pakes 1996) or intermediate consumption (Levinson and Petrin 2003). However, according to Ackerberg, Caves and Frazer (2015) these estimation strategies may suffer from identification issues. For this reason they propose an estimation procedure based on Olley and Pakes (1996) and Levinson and Petrin (2003) but which estimates all the input coefficients in the second stage.[56] Therefore, this chapter follows Ackerberg, Caves and Frazer (2015) and uses the Manjón-Antolín and Mañez (2016) command *acfest* to estimate TFP in Stata. This approach is estimated by the nonlinear, robust generalized method of moments. After estimation, the estimated productivity of the firms in the sample can be predicted. When this is done, standard estimates for input elasticities, 0.70 for labour and 0.40 for capital, are obtained (see Table C1 in the Appendix C).

When agglomeration economies and production functions are estimated, issues of endogeneity arise. Endogeneity at the local level can arise because some missing variables can simultaneously determine agglomeration economies and the local outcome. Here reverse causality is a relevant issue when higher outcome levels attract more firms and workers, which increases the quantity of

[56] Since some authors strongly recommend comparing different approaches before choosing among them (Combes and Gobillon 2015), TFP is also estimated by by following Levinson and Petrin (2003) approach and by OLS. Still, as results do not seem to vary significantly TFP results are presented according to Ackerberg, Caves and Frazer (2015) approach.

local labour and therefore, density at the same time. If this is the case, a positive bias in the estimated coefficient of density is expected.

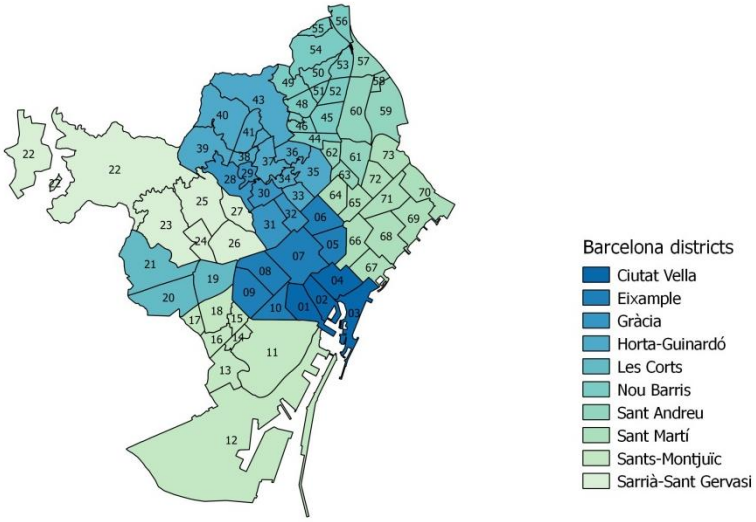
Combes and Gobillon (2015) summarise the main approaches for dealing with these issues: for example, local fixed effects (FE), instrumental variables (IV), the generalised method of moments (GMM) and natural experiments. Even the same authors do not recommend relying on GMM when the final aim is to identify the role of local determinants on local outcomes. Therefore, choosing one or another is a complex decision and requires a careful methodological design.

TFP is estimated for some factors that influence firm performance by using different approaches. Still, working with panel data offers some advantages over cross-section data as highlighted in Hsiao (2014). The introduction of standard fixed effects on the regression will potentially reduce the correlation effects of the explanatory variables with unobservables. In accordance with the main aim of this chapter, estimating the model by robust OLS with standard fixed effects makes it possible to deal with main estimation issues and analyse the individual effects of urban amenities and demand factors.

3. Data and variables

The firms in this dataset are located in Barcelona, the capital of Catalonia, an autonomous region in north-eastern Spain. Barcelona has an area of 101.9 km² and is home to more than 1.6 million people. In economic terms, it accounts for 31% and 6% of the Catalan and Spanish GDP, respectively. Barcelona is composed of 10 districts and 75 neighbourhoods (see Figure 1 and Table C3 in the Appendix C).

Figure 1. Study of Area: Barcelona Neighbourhoods



This study uses micro-geographic data from the SABI database (Bureau van Dijk). SABI contains comprehensive information on firms in Spain, detailed by firms' geographical information (plain coordinates), employment, and among others characteristics at the 4-digit NACE level. The SABI's data covers all limited liability firms and corporations, and does not include data from neither self-employment nor public employment.[57]

This chapter follows UNCTAD's (2010) classification of CIs, the most widely accepted classification.[58] UNCTAD's classification is the broadest available in terms of industries, including both manufacturing and service industries. Even so, service creative firms are more important than manufacturing ones. In this chapter only Creative Service Industries (CSIs) are considered as Boix-Domenech and Soler-Marco (2017) suggested further research should focus exclusively on CSIs because in most of the regions examined activities classified as belonging to creative manufacturing were not in fact engaged in creating but in making. Moreover, in order to take into account the specificities among CSI, the empirical approach is conducted by classifying CSIs by each knowledge base (see NACE Rev. 2 industry classification in Table 1).

As has been stated, one of the main drivers for agglomeration and coagglomeration of CIs is their type of dominant knowledge base. There are three different definitions of knowledge bases for innovative and creative activities in this literature: analytical, synthetic and symbolic. They are all defined by the mixture of tacit and codified knowledge, the possibilities and limitations of knowledge codification and the competences and skills required for the development of their activity (Asheim and Hansen 2009; Asheim and Parrilli 2012). The analytical knowledge base contains activities in which knowledge is highly codified and the need for tacit interaction is lower (as in R&D and engineering activities). The synthetic knowledge base is partially codified, requires more tacit knowledge, and is more dependent on the context (as in architecture and software and computer-related activities). Finally, the symbolic knowledge base is associated to the creation of new ideas and images and is highly tacit and context-specific (as in advertising, arts, cinema, fashion design, publishing, and TV and radio).

[57] Previous studies have used this database (Duch et al. 2009, Jofre-Monseny and Solé-Ollé 2009 or Jofre-Monseny et al. 2015) and some of them have explored its representativeness by computing the correlation between SABI and the Social Security Register and finding a high correlation of around 0.90 (Jofre-Monseny et al. 2014).

[58] CIs arose out of cultural activities. The term came to the fore after publication of reports by the OECD (2007) and UNCTAD (2010) and the British Government's Creative Industries Task Force Mapping Document (DCMS 2001). All of them are well accepted in the literature as alternative classifications.

Table 1. Creative service industries by knowledge bases (NACE Rev. 2 codes)

Code	Symbolic CSIs	Code	Synthetic CSIs	Code	Analytical CSIs
58	Publishing	5821	Publishing of computer games	721	Scientific research and development
59	Audiovisual	5829	Other software publishing	722	Research and experimental development on social sciences and humanities
60	Programming and broadcasting	6201	Computer programming activities		
73	Advertising	6202	Computer consultancy activities		
7410	Design	7111	Architectural activities		
7420	Professional photography	7112	Engineering activities and related technical consultancy		
90	Arts				
91	Heritage				

Source: Elaborated from UNCTAD (2010) and following Asheim and Hansen (2009) classification of knowledge bases

In Table 2 the temporal composition of the number of incumbents of CSIs firms depicts growth in the first period followed by a period of attrition for both CSIs and non-CSIs, following the economic trend of the period.

Table 2. Temporal composition of the number of firms by category

Year	Non-CSIs	CSIs	Analytical	Synthetic	Symbolic	Advertising	Design
2006	5,753	1,806	34	610	1,252	511	116
2007	5,883	1,803	32	592	1,270	523	123
2008	7,079	2,201	49	793	1,473	614	141
2009	7,594	2,288	50	826	1,523	623	154
2010	7,722	2,264	53	836	1,487	614	149
2011	7,790	2,240	53	845	1,444	589	148
2012	7,865	2,142	53	812	1,369	564	141
2013	7,507	2,014	56	775	1,274	539	126
2014	7,047	1,925	51	746	1,215	513	127
2015	6,206	1,655	41	630	1,049	442	111

Source: Own elaboration with SABI's database.

The empirical strategy is applied for seven different samples. The first two are for CSI and non-CSI firms for purposes of comparison. The following ones allow to distinguish between the three different CIs knowledge-bases – symbolic, synthetic and analytical. And the last two samples are for some of the most representative CSIs in Barcelona: advertising and design industries. These

samples are obtained after data about those firms that opened and closed in the same year, and for which geographical coordinates are not available, had been excluded leaving only active firms throughout the period (2006 - 2015). Moreover, observations for which value-added, employees, intermediate materials and capital data are missing, negative or null have been omitted. Finally, monetary variables using the industrial-level and consumption are deflated using price indexes provided by IDESCAT (2011).

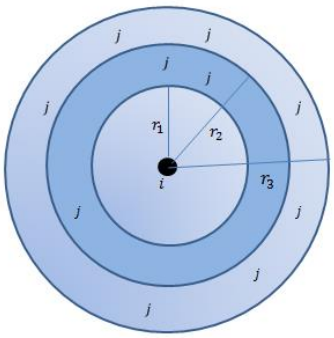
3.1. The variables

Table 3 summarises all the definitions and sources of variables. All the variables used in this chapter can be classified by categories: TFP variables for the first step in the empirical approach; and variables controlling for firm characteristics and local characteristics, as well as key variables capturing localisation and urbanisation economies for the second step. Table A2 in the Appendix shows usual descriptive statistics for the full sample of CSIs in Barcelona between 2006 and 2015.

Firm's value-added, labour, intermediate inputs and capital (measured at the beginning of the year) are directly taken from the SABI database, as are the variables aiming to control for firm characteristics, size in terms of number of employees and type of firm in terms of capital. However, agglomeration economies variables and urban amenities require more elaboration.

For each CSI, a set of concentric ring firm variables is constructed, each of which measures the number of firms in CSIs *j* present at a given distance (*r*) from the firm of reference *i* (see Figure 2). They can be understood as a measure of access of that firm to nearby neighbour firms (CSI firms for localisation economies and non-CSI firms for urbanisation economies) in each year from 2006 to 2015 in the city of Barcelona. Two first rings at intervals of 250 metres are defined and then the following three rings moving out in increments of 500 metres, based on the coordinates of each firm as a reference: 0 to 250 metres, 250 to 500 metres, 500 to 1000 metres, and 1000 to 1500 metres. Other ring divisions were considered, but bearing in mind previous studies analysing the attenuation of networking spillovers for advertising agencies in Manhattan (Arzaghi and Henderson 2008) and the spatial extent of agglomeration and coagglomeration for CIs in Barcelona found in Chapter 4, CIs seem to only benefit from localisation economies within the first kilometre. Thus, taking into account these findings using these ring divisions should capture the effect of both localisation and urbanisation economies.

Figure 2. Creating concentric ring firm variables

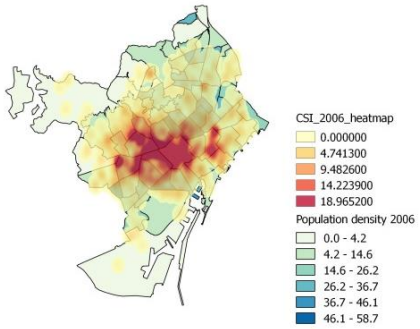


To elaborate local characteristics variables, GIS methods are used to count the stock of amenities within the first 1000 metres from the firm of reference for all firms on the dataset in Barcelona. These variables made it possible to distinguish between different kinds of urban amenities that are strongly associated with CSI: specialised human capital training centres, cultural heritage, natural amenities, and art factories. To capture market potential effects, two different variables are considered: population density, which is created by using a GIS contour fitting routine from census data at a neighbourhood level; and distance to the most frequented areas, which is created by first estimating the maximum density of public transport access points from OSM data and then, obtaining the geographical coordinates of this point in order to compute the Euclidean distance from each firm to this highly frequented point of the city.[59]

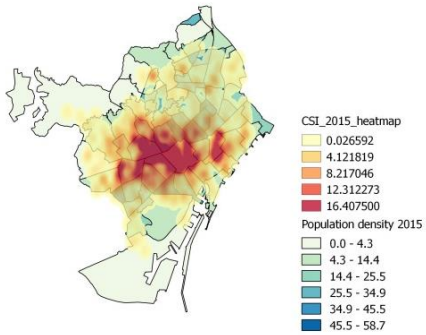
[59] Alternative proxies for potential demand have been drawn up and tested in the same model as a robustness check. Specifically, distance to different hotspots in the city (economic activity, face-to-face interaction, nightlife, tourism, events, etc.). However, these variables are usually correlated to localisation and urbanisation firm ring variables and when they are used, results slightly vary.

Figure 3. Spatial distribution of CSI firms and potential demand variables

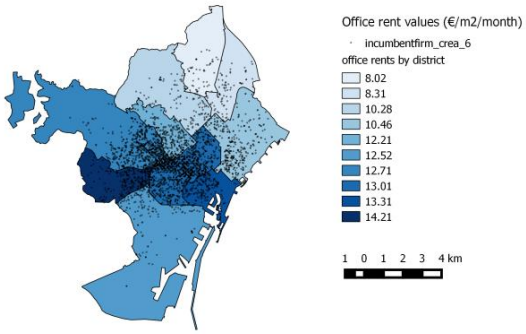
3.1 CSI firms heatmap and population density by neighbourhoods (2006)



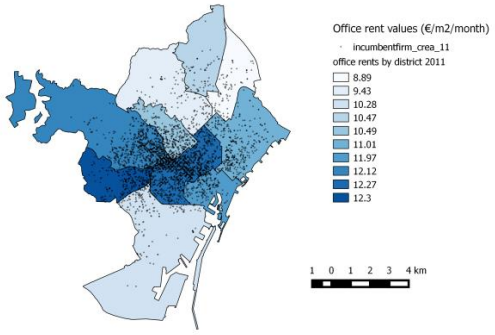
3.2 CSI firms heatmap and population density by neighbourhoods (2015)



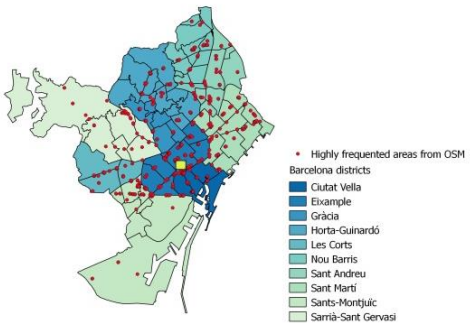
3.3 Office rents and CSI firms by districts (2006)



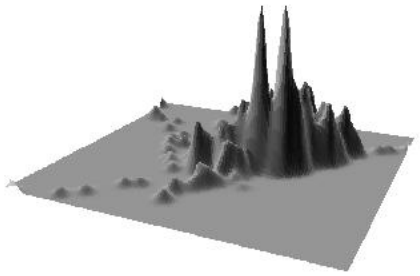
3.4 Office rents and CSI firms by districts (2011)



3.5 Highly frequented areas



3.6 Density map of public transport access points



Source: Own elaboration with OSM, Barcelona Council and SABI's data.

Figure 3 depicts the spatial distribution of CSI firms, the population density of the neighbourhoods, office rents prices by districts and main public transport access density points for the city of Barcelona. All of them reveal that CSIs seem to locate largely where potential demand is highest. Moreover, this tendency of CSIs to locate in the city centre is quite persistent from 2006 to 2015.

Table 3. Description of variables and sources

Variable	Definition	Source
TFP variables		
VA	Value-Added (Ln).	SABI (2006 - 2015)
L	Number of employees (Ln).	SABI (2006 - 2015)
K	Total assets (Ln).	SABI (2006 - 2015)
M	Intermediate materials (Ln).	SABI (2006 - 2015)
age	Firm age in years defined as the difference between the year of creation and the last data available on the database (Ln).	Own elaboration with SABI (2006 - 2015)
TFP	Total Factor Productivity estimated by using Ackerberg-Caves-Frazer Method (Ln).	Own elaboration with SABI (2006 - 2015)
Firm Characteristics		
size	It indicates if the firm is a micro firm (1), a small firm (2), a medium firm (3); or a large firm (4).	Own elaboration with SABI (2006 - 2015)
firm_type	Dummy variable taking value (0) if it is a Joint-stock company or (1) for a Limited Company.	Own elaboration with SABI (2006 - 2015)
Localisation economies		
Intra_$ _0-250	Count of $ [a] within a ring of 250 metres from the firm of reference (Ln).	Own elaboration with SABI database (2006 - 2015)
Intra_$_250-500	Count of $ within a ring between 250 and 500 metres from the firm of reference (Ln).	Own elaboration with SABI (2006 - 2015)
Intra_$_500-1000	Count of $ within a ring between 500 and 1000 metres from the firm of reference (Ln).	Own elaboration with SABI (2006 - 2015)
Intra_$_1000-1500	Count of $ within a ring between 1000 and 1500 metres from the firm of reference (Ln).	Own elaboration with SABI (2006 - 2015)
Urbanisation economies		
Inter_Non$_0-250	Count of non-$ within a ring of 250 metres from the firm of reference (Ln).	Own elaboration with SABI (2006 - 2015)
Inter_Non$_250-500	Count of non-$ within a ring between 250 and 500 metres from the firm of reference (Ln).	Own elaboration with SABI (2006 - 2015)
Inter_Non$_500-1000	Count of non-$ within a ring between 500 and 1000 metres from the firm of reference (Ln).	Own elaboration with SABI (2006 - 2015)
Inter_Non$_1000-1500	Count of non-$ within a ring between 1000 and 1500 metres from the firm of reference (Ln).	Own elaboration with SABI (2006 - 2015)
Local characteristics		
Pop_density	Population density by neighbourhood – inhabitants by km^2 (Ln).	Own elaboration with Statistics Department of Barcelona Council data (2006-2015)
Dist_metro	Distance to highly frequented areas as metro stations (Ln).	Own elaboration with OSM data (2006-2015)
Specialised_hk_adv_den_1000m	Count of schools or formation centres specialised in advertising within a ring of 1000m (Ln).	Own elaboration with http://meet.barcelona.cat/ data (2006-2015)
Specialised_hk_design_den_1000m	Count of schools or formation centres specialised in design within a ring of 1000m (Ln).	Own elaboration with http://meet.barcelona.cat/ data (2006-2015)
Heritage_den_1000m	Count of cultural monuments within a ring of 1000m (Ln).	Own elaboration with http://meet.barcelona.cat/ data (2006-2015)
Nature_den_1000m	Count of natural amenities such as public parks or beaches within a ring of 1000m (Ln).	Own elaboration with http://meet.barcelona.cat/ data (2006-2015)
Art_factories_den_1000m	Count of Art Factories within a ring of 1000m (Ln).	Own elaboration with http://meet.barcelona.cat/ data (2006-2015)

Note: [a] $ refers to the firm of reference.

4. Results

Here the main results are shown. First, the results of all CSIs are compared to those of non-CSI and then to the results for each knowledge-based CSI (symbolic, synthetic and analytic). Finally, advertising and design sectors are analysed individually. The main objective is to infer the intensity and attenuation of agglomeration economies on firm' performance taking into account other factors that can determine their productivity.

4.1. Results for non-CSIs, CSIs and knowledge-based CSI firms' performance

Table 4 shows the results for non-CSIs (column 1) and CSIs (column 2), as well as for each kind of knowledge-based CSI. As stated in Section 3, all explanatory variables in the model are potentially correlated with omitted variables. To respond to this issue time fixed effects are added to the robust OLS regression for panel data.[60]

For both non-CSIs and CSIs, coefficients for the dimension of firms indicate that there are no improvements in TFP when the size of firms increases. However, limited capital firms lead to better TFP results. These control variables may be capturing the effect of age, rather than the effect of dimension. In other words, since the younger firms, are also the smallest, they are more efficient because they have innovative business proposals. The attenuation of localisation economies is confirmed for both non-CSI and CSI firms. However, although their effects seem to be more important at reduced distances, there are positive effects at more than 1000 metres for both kinds of industry. Results were mixed for urbanisation economies, which may be more a long-term phenomenon. Even so, the positive effect of having CSI firms within a range of 250 and 500 metres from non-CSI ones should be highlighted since it provides evidence of positive interaction between the two industries. Population density and distance to highly frequented areas as a proxy for potential demand do not seem to offset localisation economies for either non-CSI or CSI firms' productivity. The effects of urban amenities on CSIs were mostly positive but non-significant (i.e., cultural heritage and natural amenities), but for non-CSIs they were all negative, which may indicate that these non-creative activities may be less attracted to those amenities. Furthermore, a higher density of art factories in the near proximity (within 1 km) is positive and significant for CSIs, while it is negative and significant for non-CSIs. This result confirms the greater need of CSIs for face-to-face interaction to facilitate the exchange of ideas and collaboration among their different creative fields.

[60] Alternatively, sector and trend fixed effects were added as robustness checks. However, as they are considerably correlated with localisation and urbanisation firm ring variables, they were finally discarded.

As shown in previous regressions for all CSI firms, the expectations of finding a clear intensity and attenuation of localisation economies have not been clearly confirmed. So, applying the same analysis to each kind of knowledge-based CSI could help to clarify this evidence as their behaviour is assumed to depend on their tacit interaction and context specific needs. Results are presented in columns (3), (4) and (5) of Table 4.[61]

For all three types of knowledge base, coefficients for firm characteristics indicate that there are no improvements of TFP when the size of firms increases. However, for synthetic and analytical based firms the main hypothesis can still not be confirmed, so an in-depth analysis for symbolic-based CSI is conducted (see column 3). Unlike other knowledge-based CSIs, increasing the number of symbolic-based firms within the first 250 metres from the firm by 10%, and keeping the size of other sectors in the area constant, increases the TFP of a symbolic-based firm by 0.99%. However, this effect turns out to be negative but non-significant at 500 metres. This result is consistent with the results of Arzaghi and Henderson (2008) for advertising agencies in Manhattan, and with those of Chapter 4 of this thesis. In this regard, any inferred networking effects end at ring 2, upholding the hypothesis about the critical role played by spatial proximity in networking effects (face-to-face interaction). Interactions in symbolic-based CSIs occur primarily within 250 metres, that is, a 10-minutes walk in daily crowds of Barcelona. Urbanisation economies seem to positively affect the TFP of symbolic-based firms within the second ring, which seems to benefit from the diversity of activities even though are negative when distance increases. As far as local characteristics are concerned, only the proximity to highly frequented areas as a proxy for potential demand is significant, which upholds the hypothesis that even when controlling for demand factors, those localisation effects do not disappear. Finally, the density of art factories within the first kilometre from each firm has a positive and significant effect on CSIs TFP. Thus, the proximity to co-working spaces may favour the networking of creative individuals and enhance CSIs productivity.

All in all, these results confirm that for CSIs the spatial extent of agglomeration economies is still relevant when demand factors are taken into account. They also show the positive effects of having creative activities nearby for non-CSI and that CSIs that are most reliant on networking (face-to-face interaction) and context specific characteristics – i.e., symbolic-based activities – benefit from localisation economies at short distances although this effect rapidly decays with distance.

[61] Robustness for these results is assessed by using alternative econometric approaches. Table C.4 in the Appendix C shows the results for symbolic-based CSIs. The robust OLS results are compared to FE, FE including the interaction of time dummies and time-invariant regressors, IV FE and random effects (RE).

Table 4. Results for non-CSI, all CSI and for each knowledge-based CSI

Dep. var.:	TFP [62]				
Model	(1) Non-CSI	(2) CSI	(3) Symbolic[b]	(4) Synthetic[c]	(5) Analytical[d]
Size					
Small	-0.698***	-0.524***	-0.541***	-0.530***	-0.446***
	(0.0104)	(0.0207)	(0.0284)	(0.0273)	(0.144)
Medium	-1.559***	-1.368***	-1.481***	-1.276***	-1.655***
	(0.0229)	(0.0508)	(0.0644)	(0.0907)	(0.210)
Large	-2.634***	-2.253***	-2.458***	-2.225***	-1.921***
	(0.0722)	(0.118)	(0.165)	(0.115)	(0.338)
Limited Company	0.0108	0.106***	0.112**	0.116***	-0.0525
	(0.0165)	(0.0337)	(0.0449)	(0.0434)	(0.189)
Intra_$_0-250 [a]	0.0739***	0.0587**	0.0990***	0.0306	0.0271
	(0.0166)	(0.0262)	(0.0333)	(0.0298)	(0.101)
Intra_$_250-500	-0.0944***	0.0113	-0.00408	0.0484	0.0816
	(0.0240)	(0.0346)	(0.0470)	(0.0410)	(0.122)
Intra_$_500-1000	0.0535*	0.00327	-0.0473	0.0250	-0.250
	(0.0274)	(0.0447)	(0.0631)	(0.0851)	(0.177)
Intra_$_1000-1500	0.00294	0.0365*	0.107	0.0528	-0.149
	(0.0210)	(0.0204)	(0.0806)	(0.0659)	(0.173)
Inter_$_0-250	-0.0182	-0.00731	-0.0600	-0.0205	0.147
	(0.0146)	(0.0350)	(0.0422)	(0.0442)	(0.0969)
Inter_$_250-500	0.0398**	0.0340	0.109*	-0.0204	-0.0644
	(0.0196)	(0.0503)	(0.0614)	(0.0673)	(0.153)
Inter_$_500-1000	-0.00744	0.00177	0.0182	-0.0296	0.304
	(0.0231)	(0.0547)	(0.0898)	(0.0970)	(0.433)
Inter_$_1000-1500	-0.0129	-0.111**	-0.148	-0.129	-0.122
	(0.00851)	(0.0435)	(0.0975)	(0.0802)	(0.380)
Heritage_den_1000m	-0.00364	-0.0228	-0.0172	-0.00866	-0.122
	(0.00947)	(0.0180)	(0.0243)	(0.0248)	(0.126)
Nature_den_1000m	-0.0113	0.00390	0.00364	0.0154	-0.190
	(0.0122)	(0.0233)	(0.0312)	(0.0334)	(0.145)
Art_factories_den_1000m	-0.0345**	0.0573*	0.112***	-0.0149	0.100
	(0.0158)	(0.0304)	(0.0411)	(0.0415)	(0.305)
Pop_density	-0.0568***	-0.0180	-0.00727	-0.00821	-0.0512
	(0.00988)	(0.0210)	(0.0279)	(0.0293)	(0.134)
Dist_freq_areas	0.0117	0.0206	0.0789**	-0.0605*	-0.0728
	(0.0112)	(0.0226)	(0.0308)	(0.0309)	(0.139)
Time FE	YES	YES	YES	YES	YES
Constant	0.948***	1.239***	0.565	2.555***	0.794
	(0.153)	(0.269)	(0.344)	(0.506)	(2.242)
Num. firms	10,162	2,899	1,916	1,062	64
N	62,180	17,775	11,750	6,491	400
R^2	0.373	0.238	0.259	0.260	0.301

Notes: OLS results with robust standard errors in parentheses, *** p<0.01; ** p<0.05; * p<0.1.
[a] These variables change for each kind of firm of reference and knowledge base.
[b] Symbolic based CSI include the following creative sectors: publishing, audiovisual, programming and broadcasting, advertising, design, professional photography, arts, and heritage.
[c] Synthetic based CSI include the following creative sectors: publishing of computer games, other software publishing, computer programming, computer consultancy, architecture, and engineering.
[d] Analytical based CSI include the following creative sectors: scientific research and development, and research and experimental development on social sciences and humanities.

[62] TFP is the result of the first step using Ackelberg et al. (2015)'s empirical strategy.

Even the robust OLS with time FE is the preferred approach as it makes it possible to deal with the main estimation issues and analysing urban amenities and demand factors individual effects, the robustness of the results is assessed by using alternative econometric approaches. Table C.4 in the Appendix C shows the results for symbolic-based CSIs. The robust OLS (column 1) results are compared to those of FE (column 2), FE including the interaction of time dummies and time-invariant regressors (column 3), IV FE (column 4) and random effects (RE) (column 5). The specification in column 3 (Cross FE) is the same to that of column 2; however, Cross FE specification includes the interaction of year dummies with all time-invariant variables (Heritage_den_1000m, Nature_den_1000m and Dist_freq_areas) and intra and inter-agglomeration variables in order to control for any source of unobservable heterogeneity. By focusing on Barcelona, unobserved neighbourhood characteristics include trendy places, construction, security, and neighbourhood public services for firms that can change over time. Thus, particular historical variables from the 1990 Census as instruments for population density are used. The IV FE strategy should mitigate the omitted variables bias (see Ciccone and Hall 1996; Combes et al. 2008). The number of housing units in 1990 and the historical urban population in 1900 are usually found to be extremely relevant instruments, indicating major inertia in the distribution of population over space. Moreover, the set of ring firm variables for intra and inter variables are instrumented for the same variables but with 1970 firm's stocks. Nevertheless, the use of IV does not confirm the robust OLS results, possibly, due to the debateable validity of this IV. Finally, due to the time-invariant nature of amenities and some firm-ring variables the robustness of results is only confirmed when using RE. However, the Hausman test leads to strong rejection of the null hypothesis that RE provides consistent estimates. Thus, more work is needed for the empirical strategy of this chapter.

4.2. Results for advertising and design firms' performance

The results show some heterogeneity among CSI sectors that should be taken into account in order to gain greater insight into the intensity and attenuation of agglomeration economies for these kinds of activity. So, a model adapted to the leading creative sectors in Barcelona is estimated, particularly for the advertising and design industries.

Table 5 depicts robust OLS results for the advertising industry by adding each group of independent variables sequentially in order to check for the robustness of localisation effects on TFP. As in previous regressions, coefficients for the dimension of firms indicate that there are not improvements in TFP when the size of firms increases. However, limited capital firms lead to better TFP results, perhaps reflecting the effect of age rather than the effect of dimension. For advertising firms the intensity of localisation economies is even higher than for the whole of CSIs. In particular, increasing the number of advertising firms within a 500 and 1000 metre radius of the firm by 10%, and keeping the size of other sectors in the area constant, increases the TFP of an advertising firm by 1.33%. However, the effects are only significant in the range between 500 and 1000 metres and then they quickly disappear with distance. Results for the attenuation of urbanisation economies are mixed. They may be a more long-term phenomenon. Urban amenities such as cultural heritage and nature amenities mainly have a negative and significant impact on TFP. This may be understood as a congestion effect of tourism, which diminishes the productivity of those industries that are highly agglomerated in the city centre. Also the proximity to specialised human capital and co-working spaces has a positive but non-significant effect on their productivity. Finally, population density and distance to highly frequented areas, as a proxy for potential demand, have a positive and significant effect on design firms' TFP. This result has two main implications. First, for advertising firms, there is a clear trade-off between agglomeration and disagglomeration economies, since proximity to the most populated areas of the city provides competitive advantages in terms of information flows through face-to-face interaction, networking possibilities and specific environments but, at the same time, they may suffer from the classic drawbacks of core areas (e.g., higher services and rental prices, traffic congestion, etc.) which hinders their productivity. And second, the significant coefficient for both variables confirms that, despite the relevance of demand-side factors for this industry, potential demand factors do not offset the relevance of localisation economies for advertising firms.

Robust OLS results for the design industry are shown in Table 6. As in previous regressions, the coefficients for the dimension of firms indicate that there are not improvements in TFP when the size of firms increases TFP. However, limited capital firms lead to better TFP results. As far as localisation economies are concerned, increasing the number of design firms within a 250 and 500 metre radius of the firm by 10%, and keeping the size of other sectors in the area constant, increases the TFP of a design firm by 1.30%. These effects quickly disappear with distance. Results for the attenuation of urbanisation economies are mixed. They may be a more long-term phenomenon. Here, urban amenities such as cultural heritage and nature amenities mainly have a negative but not significant impact on TFP. Because of their non-significance, these results should be interpreted carefully. They may be regarded as a congestion effect (i.e., tourism) which may hamper the daily activity of those industries that are highly agglomerated in the city centre. However, the proximity to specialised human capital training centres seems to have a robust,

positive and significant effect on their productivity. Finally, only proximity to the highly frequented areas as a proxy for potential demand is significant, which upholds the hypothesis that even when controlling for demand factors, those localisation effects do not disappear.

Table 5. Results for Advertising

Dep. var.:	TFP					
Model	(1)	(2)	(3)	(4)	(5)	(6)
Size						
Small	-0.498***	-0.497***	-0.503***	-0.505***	-0.492***	-0.490***
	(0.0399)	(0.0402)	(0.0400)	(0.0399)	(0.0393)	(0.0391)
Medium	-1.577***	-1.584***	-1.593***	-1.615***	-1.628***	-1.617***
	(0.161)	(0.161)	(0.163)	(0.162)	(0.160)	(0.160)
Large	-3.213***	-3.238***	-3.245***	-3.263***	-3.236***	-3.198***
	(0.259)	(0.266)	(0.270)	(0.257)	(0.246)	(0.248)
Limited Company	0.00190	0.00301	0.00221	0.0112	0.0134	0.0107
	(0.0806)	(0.0802)	(0.0803)	(0.0809)	(0.0799)	(0.0798)
Intra_advertising_0-250	0.0480	0.0520	0.0504	0.0458	0.0640	0.0535
	(0.0353)	(0.0419)	(0.0419)	(0.0417)	(0.0406)	(0.0407)
Intra_advertising_250-500	-0.0313	-0.0398	-0.0396	-0.0169	-0.0327	-0.0290
	(0.0474)	(0.0664)	(0.0665)	(0.0654)	(0.0653)	(0.0644)
Intra_advertising_500-1000	0.109*	0.104	0.104	0.119	0.156*	0.133*
	(0.0589)	(0.0822)	(0.0823)	(0.0818)	(0.0804)	(0.0794)
Intra_advertising_1000-1500	-0.0640	-0.00992	-0.00952	-0.0151	0.0590	0.0136
	(0.0467)	(0.0983)	(0.0985)	(0.0957)	(0.0975)	(0.0968)
Inter_advertising_0-250		-0.0199	-0.0203	-0.00151	0.0126	0.0210
		(0.0598)	(0.0596)	(0.0595)	(0.0592)	(0.0582)
Inter_advertising_250-500		0.0303	0.0218	0.0120	0.0123	0.00921
		(0.0957)	(0.0969)	(0.0956)	(0.0940)	(0.0920)
Inter_advertising_500-1000		0.0101	0.0204	0.00163	-0.0206	0.000893
		(0.141)	(0.142)	(0.141)	(0.138)	(0.135)
Inter_advertising_1000-1500		-0.0759	-0.0822	-0.0691	-0.213	-0.150
		(0.138)	(0.139)	(0.135)	(0.143)	(0.141)
Specialised_hk_design_1000m			0.0559	0.0407	0.0918	0.0854
			(0.0529)	(0.0528)	(0.0581)	(0.0579)
Heritage_den_1000m				-0.0463*	-0.000375	-0.00247
				(0.0277)	(0.0369)	(0.0367)
Nature_den_1000m				-0.0635	-0.0944*	-0.0928*
				(0.0473)	(0.0489)	(0.0485)
Art_factories_den_1000m				0.125**	0.0813	0.0638
				(0.0596)	(0.0628)	(0.0629)
pop_density					0.113***	0.0950**
					(0.0388)	(0.0395)
Dist_freq_areas					0.103**	0.0995**
					(0.0485)	(0.0482)
Time FE	N	N	N	N	N	Y
Constant	1.094***	1.338***	1.355***	1.333***	0.927	0.586
	(0.130)	(0.494)	(0.496)	(0.488)	(0.622)	(0.625)
Num. firms	798	798	798	798	798	798
Observations	4,823	4,823	4,823	4,823	4,823	4,823
R^2	0.272	0.272	0.273	0.276	0.282	0.288

Notes: Robust standard errors in parentheses, *** p<0.01; ** p<0.05; * p<0.1.

Table 6. Results for Design

Dep. var.:	TFP					
Model	(1)	(2)	(3)	(4)	(5)	(6)
Size						
Small	-0.531***	-0.549***	-0.556***	-0.549***	-0.545***	-0.550***
	(0.0851)	(0.0881)	(0.0861)	(0.0828)	(0.0826)	(0.0839)
Medium	-2.444***	-2.407***	-2.491***	-2.458***	-2.488***	-2.473***
	(0.115)	(0.121)	(0.123)	(0.130)	(0.139)	(0.150)
Large	-	-	-	-	-	-
Limited Company	-0.135	-0.136	-0.140	-0.131	-0.129	-0.129
	(0.156)	(0.160)	(0.154)	(0.148)	(0.154)	(0.155)
Intra_design_0-250	0.138*	0.128*	0.133*	0.130*	0.130*	0.130*
	(0.0717)	(0.0726)	(0.0727)	(0.0755)	(0.0755)	(0.0764)
Intra_design_250-500	0.000395	-0.00660	-0.0374	-0.0331	-0.0402	-0.0375
	(0.0583)	(0.0594)	(0.0599)	(0.0612)	(0.0625)	(0.0630)
Intra_design_500-1000	0.0519	0.0755	0.0521	0.0560	0.0667	0.0733
	(0.0643)	(0.0833)	(0.0837)	(0.0834)	(0.0847)	(0.0865)
Intra_design_1000-1500	-0.116	-0.0864	-0.0832	-0.0817	-0.0836	-0.0800
	(0.0772)	(0.0900)	(0.0886)	(0.0905)	(0.0892)	(0.0912)
Inter_design_0-250		0.00926	0.0314	0.0255	0.00282	0.00115
		(0.0918)	(0.0931)	(0.0934)	(0.100)	(0.101)
Inter_design_250-500		0.0676	0.0767	0.0867	0.1000	0.101
		(0.0979)	(0.0966)	(0.0971)	(0.101)	(0.101)
Inter_design_500-1000		-0.101	-0.0756	-0.0826	-0.0979	-0.107
		(0.195)	(0.189)	(0.188)	(0.187)	(0.190)
Inter_design_1000-1500		-0.0167	-0.0799	-0.0876	-0.0655	-0.0618
		(0.150)	(0.147)	(0.145)	(0.150)	(0.151)
Specialised_hk_design_1000m			0.118*	0.120*	0.120*	0.118*
			(0.0643)	(0.0643)	(0.0649)	(0.0654)
Heritage_den_1000m				-0.00969	-0.0270	-0.0287
				(0.0624)	(0.0797)	(0.0800)
Nature_den_1000m				-0.0400	-0.0377	-0.0364
				(0.0767)	(0.0759)	(0.0756)
Art_factories_den_1000m				-0.0340	-0.0195	-0.0151
				(0.128)	(0.129)	(0.129)
Pop_density					-0.0368	-0.0407
					(0.0793)	(0.0814)
Dist_freq_areas					-0.0435	-0.0430
					(0.102)	(0.102)
Time FE	N	N	N	N	N	Y
Constant	1.441***	1.774***	1.910***	2.013***	2.448**	2.430**
	(0.200)	(0.527)	(0.515)	(0.550)	(1.222)	(1.227)
Num. firms	185	185	185	185	185	185
Observations	1,186	1,186	1,186	1,186	1,186	1,186
R^2	0.066	0.069	0.076	0.077	0.079	0.082

Notes: Robust standard errors in parentheses, *** p<0.01; ** p<0.05; * p<0.1

5. Conclusions

The aim of this chapter was to infer the intensity and spatial extent of agglomeration economies for creative industries (CIs) in Barcelona and their relationship with the performance of creative firms. Using micro-geographic data for firms between 2006 and 2015 and GIS techniques the effects of intra- and inter-industry agglomeration around location on productivity in Barcelona were

estimated. The main results are, (1) for creative service industries (CSIs), at a micro-spatial level, localisation economies are important within the first 250 metres; (2) for non-CSI having creative workers in close proximity (250 - 500 metres) seems to enhance their productivity; (3) for symbolic-based CSIs and design firms, localisation economies – mainly understood as networking and knowledge externalities – have positive effects on TFP at shorter distances (less than 250 metres), while for the two other knowledge-based CSIs (i.e., synthetic and analytical) localisation economies seem not to be so important; (4) CSI productivity is largely associated with proximity to specialised human capital and co-working spaces; and (5) the benefits of being located in a better neighbourhood seem to be associated not only with higher market potential effects.

All these results suggest the importance of networking or information spillover effects for some creative activities, specially, for symbolic-based CSI – such as advertising or design agencies, which are highly concentrated in the core areas of the largest cities. These findings confirm initial expectations and complement previous contributions (see Arzaghi and Henderson 2008 and Currid and Williams 2010, among others). The chapter also contributes to the literature on CIs by using GIS techniques and distance-based methods to provide in-depth analysis of agglomeration effects on firm productivity when market potential effects are taken into account.

At this point, these findings raise some policy implications. First, policies focusing on CIs should take into account both sectoral specificities and all the essential elements they share since the impact of agglomeration economies on their productivity do change among them. Second, because of this evident concentration of creative activities in the city centre, it seems clear that agglomeration advantages largely compensate for agglomeration diseconomies involved in being located in the city centre (up to 500 km for most CSI). In this regard, these results suggest that those firms aiming to locate in Barcelona should take into account that they may benefit from agglomeration effects if they locate within a radius of 500 km from the core neighbourhoods of the city and that urban policies aiming to attract CIs should promote short-distance clusters. Third, since the agglomeration of CIs in city centres seems to be explained mainly by a path-dependence process rather than being the result of an induced cluster strategy, policy makers should focus on providing and improving the urban features and conditions that enhance the activity of these industries. In this regard, even if the proximity to urban amenities is not as important as these results seem to suggest, urban policy makers should still make an effort to maintain and revitalise them because amenities have also potential for urban development. What seems to be most important to the productivity of CSIs is that they have access to a specialised workforce and co-working spaces, so much of the council's budget efforts should be going in this direction. However, this trade-off between agglomeration and disagglomeration forces is still an important issue, and accessibility to the city centre and transport connections as well as the quality of life and social conditions in these core neighbourhoods still need to be improved. Finally, these results also

suggest that policies focusing on CIs as urban regeneration tools should bear in mind that benefits of attracting creative talents and firms may not easily spread to peripheral areas since agglomeration benefits (i.e., networking possibilities and place-image reputation) are quite local. When a CIs firm must decide on the best location, they choose one that is close to existing CIs, leading to a clear path-dependence of the agglomeration of CIs in the city centre.

Despite all this, the chapter does have some limitations. In this regard, any future research should focus on improving the empirical approach, finding alternative methods to measure CIs productivity and use of other proxies for market potential and urban amenities variables. Moreover, productive future research should extend this analysis in two main ways. Firstly, by analysing the interaction and simultaneity effects between the productivity of CSIs and non-CSIs. And secondly, by assessing the main consequences that this increasing attraction to a creative Barcelona is having on some urban phenomena (i.e., congestion, gentrification or the persistence of income and social inequalities).

Appendix C

Table C1. First step results: Ackerberg et al. (2015) TFP estimates

Dep. Var: VA	(1) All activity	(2) Manufacturing	(3) Services	(4) CSIs
K	0.412***	0.458***	0.251***	0.408***
	(0.034)	(0.052)	(0.005)	(0.032)
Age	-0.167***	0.325**	0.151***	0.263
	(0.026)	(0.036)	(0.021)	(0.028)
Labour	0.735***	0.789***	1.288***	0.920***
	(0.114)	(0.047)	(0.195)	(0.081)
N	121,226	1,436	118,161	1,629
Wald test	0.040	5.22**	478.35***	4.89**
Sargan-Hansen J-statistic	0.000	0.000	0.019	0.000

Note: *** p<0.01; ** p<0.05; * p<0.1.

Table C2. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
VA	180,228	5.34	1.55	0.01	15.03
K	180,228	6.19	1.75	0.00	17.42
L	180,228	2.00	1.12	0.69	10.22
M	180,228	5.18	2.14	0.00	15.90
Age	180,228	2.81	0.58	1.10	4.75
TFP	180,228	0.87	0.81	-8.89	7.03
Size	180,228	1.34	0.61	1.00	4.00
firm_type	180,017	1.82	0.38	1.00	2.00
Intra_CSI_0-250	166,118	2.99	1.21	0.00	5.15
Intra_CSI_250-500	166,118	3.94	1.32	0.00	5.77
Intra_CSI_500-1000	166,118	5.29	1.36	0.00	7.33
Intra_CSI_1000-1500	166,118	5.19	1.98	0.00	6.86
Inter_NonCSI_0-250	166,118	5.32	1.09	0.00	7.58
Inter_NonCSI_250-500	166,118	6.28	1.18	0.00	8.12
Inter_NonCSI_500-1000	166,085	7.55	1.17	0.00	9.13
Inter_NonCSI_1000-1500	166,118	8.02	1.05	0.00	9.28
Intra_symbolic_0-250	166,118	2.58	1.20	0.00	4.85
Intra_symbolic_250-500	166,118	3.51	1.31	0.00	5.49
Intra_symbolic_500-1000	166,118	4.77	1.35	0.00	6.39
Intra_symbolic_1000-1500	166,118	5.21	1.29	0.00	6.50
Inter_Nonsymbolic_0-250	166,118	5.35	1.09	0.00	7.61
Inter_Nonsymbolic_250-500	166,118	6.31	1.18	0.00	8.14
Inter_Nonsymbolic_500-1000	166,118	7.60	1.17	0.00	9.15
Inter_Nonsymbolic_1000-1500	166,118	8.04	1.05	0.00	9.30
Intra_synthetic_0-250	166,118	2.17	1.08	0.00	4.44
Intra_synthetic_250-500	166,118	3.07	1.23	0.00	4.90
Intra_synthetic_500-1000	166,118	4.33	1.25	0.00	5.79
Intra_synthetic_1000-1500	166,118	4.77	1.18	0.00	5.98
Inter_Nonsynthetic_0-250	166,118	5.38	1.09	0.00	7.63
Inter_Nonsynthetic_250-500	166,118	6.34	1.19	0.00	8.17
Inter_Nonsynthetic_500-1000	166,118	7.62	1.17	0.00	9.18
Inter_Nonsynthetic_1000-1500	166,118	8.07	1.06	0.00	9.33
Intra_analytical_0-250	166,118	0.61	0.90	0.00	4.78
Intra_analytical_250-500	166,118	1.12	1.13	0.00	5.44
Intra_analytical_500-1000	166,118	2.06	1.32	0.00	6.36
Intra_analytical_1000-1500	166,118	2.43	1.31	0.00	6.48
Inter_Nonanalytical_0-250	166,118	5.41	1.10	0.00	7.66
Inter_Nonanalytical_250-500	166,118	6.37	1.19	0.00	8.20
Inter_Nonanalytical_500-1000	166,118	7.65	1.18	0.00	9.21
Inter_Nonanalytical_1000-1500	166,118	8.10	1.06	0.00	9.36
Intra_adv_0-250	166,118	1.85	1.15	0.00	4.43
Intra_adv_250-500	166,118	2.69	1.31	0.00	4.94

Table A2 (Cont.). Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Intra_adv_500-1000	166,118	3.91	1.38	0.00	5.76
Intra_adv_1000-1500	166,118	4.35	1.31	0.00	5.86
Inter_Nonadv_0-250	166,118	5.39	1.09	0.00	7.63
Inter_Nonadv_250-500	166,118	6.35	1.19	0.00	8.16
Inter_Nonadv_500-1000	166,118	7.63	1.17	0.00	9.18
Inter_Nonadv_1000-1500	166,118	8.08	1.05	0.00	9.33
Intra_design_0-250	166,118	0.46	0.55	0.00	2.20
Intra_design_250-500	166,118	0.94	0.75	0.00	2.71
Intra_design_500-1000	166,118	1.88	0.91	0.00	3.53
Intra_design_1000-1500	166,118	2.24	0.89	0.00	3.66
Inter_Nondesign_0-250	166,118	5.41	1.10	0.00	7.66
Inter_Nondesign_250-500	166,118	6.37	1.19	0.00	8.20
Inter_Nondesign_500-1000	166,118	7.65	1.18	0.00	9.21
Inter_Nondesign_1000-1500	166,118	8.10	1.06	0.00	9.36
Specialised_hk_adv_den_1000m	180,228	0.28	0.38	0.00	1.10
Specialised_hk_design_den_1000m	180,228	0.58	0.54	0.00	1.79
Heritage_den_1000m	180,228	1.41	0.76	0.00	3.04
Nature_den_1000m	180,228	0.53	0.46	0.00	1.95
Art_factories_den_1000m	180,228	0.20	0.35	0.00	1.61
Pop_density	180,228	3.16	0.73	0.07	4.11
Dist_freq_areas	180,228	7.67	0.70	3.40	9.19

Notes: All variables are in expressed in natural logarithms, except for firm-type and size.

Table C3. The neighbourhoods of Barcelona

Code	Neighbourhood	Code	Neighbourhood	Code	Neighbourhood
1	el Raval	29	el Coll	46	el Turó de la Peira
2	el Barri Gòtic	30	la Salut	47	Can Peguera
3	la Barceloneta	31	la Vila de Gràcia	48	la Guineueta
4	Sant Pere, Santa Caterina i la Ribera	32	el Camp d'en Grassot i Gràcia Nova	49	Canyelles
5	el Fort Pienc	33	el Baix Guinardó	50	les Roquetes
6	la Sagrada Família	34	Can Baró	51	Verdun
7	la Dreta de l'Eixample	35	el Guinardó	52	la Prosperitat
8	l'Antiga Esquerra de l'Eixample	36	la Font d'en Fargues	53	la Trinitat Nova
9	la Nova Esquerra de l'Eixample	37	el Carmel	54	Torre Baró
10	Sant Antoni	38	la Teixonera	55	Ciutat Meridiana
11	el Poble Sec	29	el Coll	56	Vallbona
12	la Marina del Prat Vermell	30	la Salut	57	la Trinitat Vella
13	la Marina de Port	31	la Vila de Gràcia	58	Baró de Viver
14	la Font de la Guatlla	32	el Camp d'en Grassot i Gràcia Nova	59	el Bon Pastor
15	Hostafrancs	33	el Baix Guinardó	60	Sant Andreu
16	la Bordeta	34	Can Baró	61	la Sagrera
17	Sants - Badal	35	el Guinardó	62	el Congrés i els Indians
18	Sants	36	la Font d'en Fargues	63	Navas
19	les Corts	37	el Carmel	64	el Camp de l'Arpa del Clot
20	la Maternitat i Sant Ramon	38	la Teixonera	65	el Clot
21	Pedralbes	39	Sant Genís dels Agudells	66	el Parc i la Llacuna del Poblenou
22	Vallvidrera, el Tibidabo i les Planes	40	Montbau	67	la Vila Olímpica del Poblenou
23	Sarrià	41	la Vall d'Hebron	68	el Poblenou
24	les Tres Torres	42	la Clota	69	Diagonal Mar i el Front Marítim del Poblenou
25	Sant Gervasi - la Bonanova	43	Horta	70	el Besòs i el Maresme
26	Sant Gervasi - Galvany	44	Vilapicina i la Torre Llobeta	71	Provençals del Poblenou
27	el Putxet i el Farró	45	Porta	72	Sant Martí de Provençals
28	Vallcarca i els Penitents	46	el Turó de la Peira	73	la Verneda i la Pau

Taula C4. Robustness results for Symbolic-based CSIs

Dep. var.:	TFP				
Model	(1) OLS	(2) FE	(3) Cross FE	(4) IV FE	(5) RE
Size					
Small	-0.541***	-0.582***	-0.592***	-0.622***	-0.572***
	(0.0284)	(0.0395)	(0.0396)	(0.0653)	(0.0278)
Medium	-1.481***	-1.322***	-1.329***	-1.194***	-1.411***
	(0.0644)	(0.159)	(0.158)	(0.297)	(0.0857)
Large	-2.458***	-1.960***	-1.969***	-1.843***	-2.188***
	(0.165)	(0.225)	(0.219)	(0.455)	(0.152)
Limited Company	0.112**	-	-	-	0.125***
	(0.0449)				(0.0455)
Intra_symbolic_0-250	0.0990***	-0.0439	-0.0397	-1.263	0.0611**
	(0.0333)	(0.0630)	(0.0716)	(1.902)	(0.0308)
Intra_ symbolic _250-500	-0.00408	-0.0427	-0.0305	-0.0174	-0.0137
	(0.0470)	(0.0867)	(0.101)	(1.989)	(0.0454)
Intra_ symbolic _500-1000	-0.0473	0.285*	0.167	0.162	0.0692
	(0.0631)	(0.147)	(0.182)	(8.527)	(0.0658)
Intra_ symbolic _1000-1500	0.107	-0.0322	-0.0667	4.565	0.0522
	(0.0806)	(0.174)	(0.212)	(3.442)	(0.0750)
Inter_ symbolic _0-250	-0.0600	0.162	0.130	-	-0.0192
	(0.0422)	(0.150)	(0.166)		(0.0417)
Inter_ symbolic _250-500	0.109*	-0.233	-0.219	-1.189	0.0825
	(0.0614)	(0.246)	(0.282)	(10.45)	(0.0630)
Inter_ symbolic _500-1000	0.0182	0.0385	0.0437	10.10	-0.0181
	(0.0898)	(0.319)	(0.351)	(9.569)	(0.0911)
Inter_ symbolic _1000-1500	-0.148	-0.0576	0.368	-11.95	-0.155*
	(0.0975)	(0.381)	(0.542)	(9.262)	(0.0942)
Heritage_den_1000m	-0.0172	-	-	-	-0.00441
	(0.0243)				(0.0250)
Nature_den_1000m	0.00364	-	-	-	0.0123
	(0.0312)				(0.0315)
Art_factories_den_1000m	0.112***	-0.0272	-0.0879	-0.211	0.0767*
	(0.0411)	(0.0748)	(0.106)	(0.401)	(0.0406)
Pop_density	-0.00727	0.0248	0.0327	-0.575	0.0160
	(0.0279)	(0.0228)	(0.0261)	(1.255)	(0.0196)
Dist_freq_areas	0.0789**	-	-	-	0.0800***
	(0.0308)	-	-	-	(0.0310)
Time FE	YES	NO	YES	NO	NO
Time FE *Intra_symbolic_m	NO	NO	YES	NO	NO
Time FE *Inter_symbolic_m	NO	NO	YES	NO	NO
Time FE* Heritage_den_1000m	NO	NO	YES	NO	NO
Time FE*Nature_den_1000m	NO	NO	YES	NO	NO
Time FE* Dist_freq_areas	NO	NO	YES	NO	NO
Constant	0.565	0.961	-1.802	7.919	0.666*
	(0.344)	(1.301)	(5.279)	(18.56)	(0.358)
Num. firms	1,916	1,916	1,916	1,916	1,916
N	11,750	11,750	11,750	11,750	11,750
R^2	0.259	0.059	0.069	-	-
F-statistic	-	-	-	15.81***	-
Hausman Test	-	-	-	-	140.43***

Notes: Robust standard errors in parentheses, *** p<0.01; ** p<0.05; * p<0.1.

Column 4 shows results for a FE instrumented model. Population density is instrumented by the share of housing units with less than 5 units, the number of housing units in 1990 and historical population in 1900. The set of intra and inter variables are instrumented for the same variables but with 1970 firm's stocks.

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Chapter 6

Concluding remarks

Creative industries (CIs) have been highlighted for their potential in terms of local economic growth, development and competitiveness. The literature on the location patterns of CIs suggests that these industries have a greater need for agglomeration than non-CIs because of certain characteristic features – i.e., they have close connections to the aesthetics, symbolic values, and cultural path dependence of the region – and the fact that the way they work requires them to be in constant explicit and tacit contact within formal and informal networks. However, the policies focused on the agglomeration of CIs need to be justified by analysing how different their location patterns are from those of other economic activities and by testing their potential in terms of economic dynamism and economic performance. In this context, this thesis contributes to the literature by providing new relevant empirical evidence about the location patterns of CIs and by applying both traditional and innovative methodologies to analyse the agglomeration of these industries and their effects on the economy at both intra and inter-metropolitan level. The main findings of this thesis show although the location determinants of CIs are not so different from those of non-CIs, these industries are quite specific and have a greater need for agglomeration, especially for symbolic-based CIs. The thesis also confirms the positive association between CIs and economic growth in terms of firm creation and productivity. And it also suggests that the ability to attract creative activities and employment to an area strongly depends on the existing *creative milieu* and the cultural path dependence in the area. This concluding chapter summarises these main findings and discusses several implications and further extensions.

The second chapter inspects the role played by the existing spatial distribution and agglomeration economies of CIs in their location decisions. The empirical application focuses on Catalan municipalities for the period 2002-2007. The Count Data Models used provide two main results. First, creative and non-creative firms share similar location factors and they are both positively influenced by the specialisation level of the CIs in municipalities. However, when taking neighbouring effects into account, this influence is more spatially limited for creative and fashion firms whereas for non-creative firms and all firms it seems to be more geographically spread.

Second, a decision model for bohemian location is estimated and its residual is included in the first specification as an additional explanatory variable to proxy an unobserved *creative milieu* effect. The results confirm that the same unobserved *creative milieu* that favours the existence of bohemians

significantly influences firm entry. These results suggest that creative environments give municipalities comparative advantages once traditional location factors have been satisfied. Thus, this chapter contributes to the literature by shedding light on the relationship between creative environments and economic dynamism.

The third chapter investigates whether CIs lead to new firm creation. Because of the potential endogeneity of employment in CIs, this chapter relies on cultural associations and urban population in the eighteenth and nineteenth centuries as sources of exogenous variation. The empirical application focuses on Catalan municipalities for the period 2002-2007. By making use of these historical instrumental variables (IV), the results confirm the potential of CIs for new firm creation. Furthermore, analysis of IVs suggests that the intrinsic and historical personality defining the municipality – in terms of cultural associations – should explain the attraction of creative employment to the municipality and, at the same time, this should encourage the location of new firms. This chapter contributes to the literature on CIs because it is the first attempt to address potential reverse causality between CIs and economic dynamism using historical cultural associations as IVs. It also confirms that the conditions for creating or stimulating creative cities in a context of a globalised economy are dependent on cultural path dependence and the historical context of the municipalities.

The fourth chapter of the thesis provides a comprehensive intra-metropolitan analysis of the intensity and extent of the agglomeration and coagglomeration of CIs within the Metropolitan Area of Barcelona (MAB). It analyses whether the strength and extent of CIs agglomeration differs from that of non-CIs and whether these patterns change across different CI sectors. It also examines whether different CIs coagglomerate. Because of certain methodological limitations arising from the use of geographically aggregated data and area-based methods, it uses geo-referenced data for the MAB to calculate the relative distance-based M and m cumulative and density functions of agglomeration and coagglomeration.

The results show that CIs and non-CIs have different agglomeration patterns. Specifically, it finds a high agglomeration of CIs at short distances and a rapid distance decay of this agglomeration. This pattern holds for individual CI sectors. In this regard, the spatial extent of the agglomeration of CIs is very short (between 0 and 1 km). Although symbolic-based creative sectors are clearly agglomerated, other knowledge-based creative firms (such as R&D companies) and those in mature industries (such as printing) seem to be highly agglomerated but do not coagglomerate in the same areas as other CIs. These results suggest that CIs have strong specificities in terms of their location patterns and that they agglomerate in particular areas (neighbourhoods) within the city, where they easily find networks among creative disciplines, cultural infrastructures, and a higher concentration of demand for creative and cultural goods and services. Thus, this chapter contributes to the

literature on the spatial distribution of CIs by estimating the intensity and spatial extent of the agglomeration and coagglomeration of CIs within urban areas.

The fifth chapter analyses the spatial extent of agglomeration economies for CIs and its relationship with firms' performance. In particular, it tries to control for market potential effects and identify the actual role of the specific characteristics (i.e., networking opportunities, cultural amenities, place-image) that traditionally explain the spatial concentration of CIs in the city centre. To do this it uses micro-geographical data of firms located in Barcelona between 2006 and 2015. It estimates the effects of intra-industry (among CIs) and inter-industry (non-CIs) agglomeration in rings around location on productivity. Agglomeration measures and proximity to urban amenities are computed by using Geographical Information Systems (GIS) techniques.

The results show that for symbolic-based CIs firms localisation economies have positive effects on total factor productivity (TFP) at shorter distances (less than 250 metres) and they quickly disappear with distance, while for the two other knowledge-based CIs (i.e., synthetic and analytical) localisation economies seem to be less relevant. This suggests that the benefits of being in a better neighbourhood seem to be associated not only with market potential. Moreover, CIs productivity is considerably associated to proximity to specialised human capital and co-working spaces. All these results confirm the importance of networking or information spillover effects for CIs and how these effects depend on the dominant knowledge base of each creative sector, especially, for those industries that rely more on networking and context specific characteristics, such as symbolic-based CIs. The main contribution of this chapter is to present evidence on the actual effects of agglomeration economies on firms performance for the CIs within the city.

Some final considerations are worth making regarding the external validity and policy implications of the findings reported in this thesis. First, the second and third chapters give evidence about the potential of CIs for economic dynamism. Policies promoting firm entry should focus on providing and improving the local features and conditions that enhance the concentration of employment in CIs (i.e., networking possibilities, cultural infrastructures, diversity of people and activities, place-specific image, etc.). Nevertheless, public spending on the arts and cultural infraestructures, justified on the basis of their potential to enhance local competitiveness and the image of a city may be wasted if it does not increase human-scale interaction and networking possibilities. In this regard, policy makers should focus on providing and improving those urban features and conditions that enhance the activity of these industries. Still, despite the fact that the fourth and fifth chapters of this thesis have shown that connectivity with a specialised workforce, established stakeholders, producers, intermediaries, markets and consumers seems to be more important for CIs than proximity to urban amenities, policy makers should still make an effort to maintain and revitalise them.

Along the same lines, this thesis shows that certain intrinsic characteristics (an unobserved *creative milieu*) and path dependence play a major role in the success of creativity-led policies aiming to enhance local competitiveness. On the one hand, local authorities pursuing a diversified economic strategy should encourage social and cultural interaction that can engender a particular *creative milieu* (a vibrant environment fostering creativity) and give them comparative advantages once traditional location factors have been satisfied. On the other hand, it should be borne that this *creative milieu* cannot be created out of nothing. In fact, cultural synergies and personality of the municipality could have been forged centuries ago. This means that the success of policies aiming to develop a creative city and attract CIs may depend on urban history and the cultural path dependence of each city. Thus, since the location of CIs seems to be explained by a path dependence process, the actual role of public institutions should be reshaped accordingly.

The results of this thesis also confirm the great weight of Barcelona city in terms of concentration of CIs. In this regard, regional policies aiming to reduce territorial differences in Catalonia should not ignore the fact that Barcelona has a series of characteristics and factors that can not be found or imitated in other Catalan municipalities. Therefore, policies focusing on the transformation of local economies into a more diversified knowledge and creative economies should take into account that the rest of the territory should not compete with Barcelona, rather they should collaborate. Likewise, these policies will not hold for all municipalities, but must adapt to their characteristics. That is, for rural areas these strategies should preserve and emphasise the factors that define their quality of life, whilst for urban municipalities they should create and develop facilities increasing probabilities of networking and cultural experiences among creative and non-creative individuals. The results of this thesis also confirm the heterogeneity among CIs, both in terms of their industrial organisation or market orientation, and their dominant knowledge base. Thus, policies aiming to attract CIs should take into account differences among CIs if they are to be successful.

Finally, the fourth and fifth chapters suggest that one of the main concerns of those policies that encourage the agglomeration of CIs is the trade-off between agglomeration and disagglomeration economies in city centres. Indeed, the increasing attractiveness of the core areas of creative cities (like Barcelona) is increasing housing prices, congestion, gentrification and suburbanising poverty, which increases socioeconomic inequalities. In this regard, policies that focus on CIs as tools for urban regeneration and socio-economic polarization should bear in mind that the benefits of attracting creative talents and firms may not be spread easily to peripheral areas.

All in all, it is worth mentioning that CIs led policies can only be successful if particular economic, social and cultural context of each region (city) is taken into account before any assumptions are made about the policy implications suggested in this thesis. Whatever the case may be, this thesis

should provide greater insight into the complexity behind the location behaviour for these industries. To finish, the results and the limitations of this thesis may give ideas for future work that would be important for a better understanding of the determinants of the location of CIs.

1. This thesis limits its analysis of the location and agglomeration patterns of CIs to Barcelona, its metropolitan region (MAB) and all Catalan municipalities. The extension of this research to other cities or metropolitan areas would help to better design policies for attracting, retaining and creating CIs and determinate how these policies should be adapted to the intrinsic characteristics of each region or city.
2. The cross-sectional analysis conducted in the second and third chapters of this thesis could be further extended by incorporating temporal dynamics. In this regard, the use of panel data and alternative historical instrumental variables would compensate for any remaining unobserved heterogeneity or omitted variables.
3. The fifth chapter of this thesis attempts to infer the role of agglomeration economies in CIs productivity. However, the complexity behind the concept in the context of CIs requires alternative ways of capturing productivity and the benefits of agglomeration. Moreover, the econometric analysis could be extended by using natural experiments as long as data for public regulations and programs in the context of CIs are available.
4. This thesis has revealed important facts about the location patterns of CIs and their relevance to the rest of the economy. At the same time, however, this thesis suggests that the undeniable need to agglomerate in city centres might have certain drawbacks for the living and social conditions in big cities. In this regard, an exhaustive analysis needs to be made of the real implications of the agglomeration of CIs in city centres in terms of congestion, gentrification and persistence of social inequalities.
5. Finally, one of the main problems neglected by this thesis and the CIs literature are the living and working conditions of creative individuals, especially those more associated with arts. Any future research encouraging the development of Creative/Cultural/Smart Cities should take this into account.

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