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Entry determinants of the Software and Video games firms in Barcelona

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Entry determinants of the Software and Video games firms in Barcelona

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Abstract:

This paper aims to determine which reasons lead Software and Video games firms (SVE hereafter) to locate in certain areas of Barcelona. This high-tech industry is a key industry in developed economies mainly located in urban areas. To carry out this analysis, we use SVE firm entries at neighbourhood level between 2011 and 2013 and a set of covariates that capture neighbourhood characteristics (localization and agglomeration economies, high-tech amenities, diversity, human capital and crime). Our results show that *i)* SVE firms tend to choose locations with a high diversity and good high-tech amenities (e.g. 22@ district), *ii)* the importance of the localization and agglomeration economies, since spatial spillovers are a key factor for this type of firms and *iii)* the role of the diversity in the location process of these firms, since SVE firms choose places with a high diversity of cultural and creative activity.

JEL Codes: R10, R30, L86

Keywords: Software and Video games Industry, location determinants, Count Data models, Barcelona

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1. INTRODUCTION

In the last decades, the Technological Revolution has changed the way in which people interrelate, communicate and work. This revolution has caused the appearance and rise of high-tech industries, considered as a key driver of economic growth in developed countries due to their capacity in knowledge-generation, creativity and innovation. One of the most relevant high-tech industries, with a huge economic impact and economic growth and analyzed in this study is the Software and Video games industry (SVE hereafter).

When we refer to software, there are many ways to define it but, in a general definition, software is a set of instructions, information and/or programs that are given to a computer to do some specific tasks. Thus, when we refer to SVE industry, we are considering a wide variety of firms, as Software development firms, Software management firms or Video games firms (companies that combine Software development with a more creative component in order to create electronic entertainment games).

The impact of this industry in the current world economy is huge and it is growing over time. Indeed, in 2014, the total contribution of this industry in terms of GDP to the European Union (EU) economy was more than 900 billion euros (7.9% of the EU28 GDP). In the same year, this industry generates more than 11.6 million jobs (5.3% of the EU28 jobs), of which 3.1 million were direct jobs. In terms of wages, in this industry are pretty higher compare to other industries (e.g. the EU wage average for the software industry is 34% higher than the EU wage average and 80% higher than the services sector wage average), this is because it is a highly qualified industry with high-skill workers. In the case of Spain, the total value-added GDP is more than 35,800 million euros (3.4% of the Spanish GDP) and more than 624 thousand jobs are SVE industry related (219 thousand direct and 400 thousand indirect jobs)[1]. In Spain, this sector provides 360 thousand employees (whose average salary is over 30 thousand euros per year) and adds 30 billion euros of gross output to the Spanish economy[2]. However, the impact of the SVE industry is broader and higher than economic indicators suggest.

[1] BSA "Software: A €910 Billion Catalyst for the EU Economy".
[2] INE (Instituto Nacional de Estadística), Sector ICT indicators, ed. 2013.

SVE industry belongs to the Information and Communication Technologies (commonly known as ICT) and is considered as a Creative industry. Creative industries are economic activities which are closely linked to the generation of knowledge (i.e. advertising, crafts, fashion, film and music, among others) (Howkins, 2001). In these industries, human capital plays a crucial role, since it is the main input and can make the difference between the success and failure of economic activity. The location patterns of Creative firms have appeared as an interesting topic for researchers, since Creative firms have emerge as an important factor in local economic growth and development (Coll-Martínez et al. 2017). Also, the appearance of creative firms improve the competitiveness and diverseness of local economies (De Propris, 2013).

In the case of SVE, this industry is located mainly in urban areas, since there are good infrastructures, good accessibility to amenities, high level of human capital (i.e. more educated people), and therefore, these are environments where information and contacts between firms flows easily. Due to the importance in economic terms and economic growth of this industry, a large number of cities, as a strategy to attract this type of firms, have develop urbanistic projects aiming to create technological districts (e.g. Méndez-Ortega and Arauzo-Carod, 2018, which shows the case of the 22@ district in Barcelona, *Hafencity* district in Hamburg or *Confluence* district in Lyon).

Most of previous empirical research in location determinants of high-tech firms has been done at country and/or regional level, even being this industry purely urban. For this reason, this paper contributes to the literature filling the lack of empirical studies that analyze location determinants of SVE industry at urban level, dealing with factors that either had not been taken into account, or had not been analyzed together at this scale (i.e. traditional factors as agglomeration economies, human capital and amenities, social factors as cultural and creative diversity, and crime factors, widely used in US studies but not in European studies).

Our main results show that at city level, SVE firms tend to choose locations with a high diversity of creative firms, social amenities and high-tech amenities (*e.g.* 22@ district). It is also shown the importance of agglomeration economies, SVE firms choose locations with a large number of established SVE firms, fact that evidences the importance of spatial spillovers for this type of firms.

The rest of the paper is organized as follows. Section 2 reviews the theoretical and empirical literature about SVE firm's location determinants. Section 3 describes data and econometric methodology. Section 4 introduces and discusses the main results. Finally section 5 presents the main conclusions.

2. LOCATION OF SOFTWARE AND VIDEO GAMES FIRMS AT INTRA-URBAN SCALE

Firm location determinants have been one of the most studied topics in Urban and Regional Economics since the seminal work of Marshall (1890), where it was able to explain the location of new plants at industrial districts. Since that time and to this day, firm's location decision has constituted an important and relevant topic for academics from different areas and at the same time, constituting a great interest topic for firms, since an optimal location of the firm supposes a greater profit, market accessibility and in general, could mark the difference between success and business failure[3].

Throughout the 20th century, most of research in industrial location, agglomeration and industrial patterns were focused on theoretical issues, with few empirical studies, mainly related on manufacturing industries. Since a few years ago, empirical studies in industrial location have been changing from manufacturing industries to high-tech industries, due to the interest they arouse that boost entrepreneurship and economic growth (Gilbert, 2017). This interest is even higher if we refer to the Information and Communication Technological industries (commonly known as ICT industries), where in the last years a big amount of researchers have been analyzed the location of these industries and how they clustered due to their impact across every economic industry (Fernhaber et al., 2008; Giblin, 2011).

The most part of these studies were focused in location at regional or country level, but less is known about the location determinants of these industries at urban level, even being the location of these industries purely urban. The main interest in urban theory which suggest that economic performance is higher in cities comes from the novel work of Jacobs (1969) and Lucas (1988), where it proved that this performance is due to the huge density of human capital. Hence, this type of industries have boosted the growth of large

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[3] An extensive empirical review in industrial location can be found in Arauzo-Carod et al., (2010).

cities, since it has been observed that cities where there was a high human capital endowment grew substantially more than those where there was a short human capital endowment (Berger and Frey, 2016).

Location determinants of Software and Video games firms

The spatial concentration of high-tech activities is an established fact almost in every developed city around the world. There is a lengthy body of literature which explain the nature and extent of urban agglomeration economies (for a survey, see Duranton and Puga, 2004; Rosenthal and Strange, 2004).

The intra-metropolitan location decision is based basically in cost minimization and not firms' profit, since for high-tech activities consumer demand for output is assumed not to vary within intra-metropolitan locations (Gómez-Antonio and Sweeney, 2018). Then, the cost function (*C*) for a firm selecting a location has been represented in the literature as the function[4]:

$$C = F(AE, G, HC, t, LP, S)$$

, where *AE* are the agglomeration economies, *G* are the public services in the area (e.g. transport services, Wi-Fi public services, public centers, urban renewal areas made by public initiative, among others), *HC* is the human capital or skilled labor in the area, *t* and *LP* are the effective tax rate and land price and *S* is a vector of general site characteristics (i.e. covariates as the presence of technological parks, universities, creative diversity, crime in the area and other site characteristics that affect on high-tech firms' location characteristics). Numerous empirical studies prove the impact of this variables on firms' location decision, as shown below.

Several empirical studies have shown the positive impact of agglomeration economies as a location determinant for high-tech industries at regional/country level (e.g. Audretsch and Lehmann, 2005 and Kinne and Resch, 2017, for the case of germany or Frenkel, 2012, for the case of Israel, among others) or at metropolitan level (e.g. Arauzo-Carod and Viladecans-Marsal, 2009, for Barcelona and Hackler, 2003, for a set of US metropolitan areas). The main reason that leads these firms to allocate close each other is the creation of networks, input and output linkages and an improvement of the product

[4] These covariates and specification for high-tech firms location are in line with the literature (see Brülhart et al., 2012 and Gómez-Antonio and Sweeney, 2018).

and process innovation (Lyons, 1995). This attraction seems to be more intense with some creative sectors, as video and film industries, advertising or radio and TV firms, due to their similar and connected activities (Méndez-Ortega and Arauzo-Carod, 2018).

An important location determinant for SVE firms is the availability of good amenities. A city with a good allocation of high-tech amenities is a city that attracts a large number of SVE firms. One of the promoted amenities that has given successful results attracting knowledge-based and high tech firms are "techno-neighborhoods" (Duvivier and Polèse, 2017). These are places inside the city with a large number of resources for firms that facilitate the interaction between them. An example is the success case of 22@ district in Barcelona, an urban renewal project promoted in Barcelona aiming to attract many high-tech firms (Viladecans-Marsal and Arauzo-Carod, 2012). Also worth noting amenities as Wi-Fi hotspots inside the city, since it can be a proxy of virtual vitality and therefore, and indicator of urban vitality (Kim, 2018), contributing to the creation environments for the generation of knowledge.

Also, a significant factor for the location of SVE firms are cultural and creative diversity, since nowadays high-tech firms make location decisions based on where talent people is located. As Florida and Gates (2003) suggested, there is a connection between the level of tolerance of a metropolitan area, jointly with its ethnic, social and cultural diversity and the attractiveness of this area for talented people in high-tech firm, generating the appearance of this type of firms as an indicator of a metropolitan area's high-technology success. Then, as empirical evidence suggests, places with a huge creative diversity and a good social environment (i.e. tolerance and talent) are places where high-tech and knowledge Intensive firms will be located (Yamamura and Goto, 2018; Zandiatashbar and Hamidi, 2018).

As mentioned earlier, human capital is a basic and strategic input for SVE firms. For this reason, it is important to remark the role of the higher education providers (i.e. universities, research centers and tertiary education institutions) on the human capital formation. Cities with high education activity tend to have a large share of high educated workers (Abel and Deitz, 2012). The impact of these institutions is not only in the human capital formation, but also in the generation of knowledge, R&D activities, innovation processes and externalities. This explain the location of new firms close to this institutions, since university spillovers are relevant for high-tech firms (Acosta et al., 2011) and R&D firms in general (Abramovsky and Simpson, 2011).

Moreover, other significant factors are the rental prices and taxes. Generally, firms will choose locations where prices and taxes are lower. Some empirical studies show the negative effect of prices and taxes in the location of high-tech firms (e.g. Acosta et al., 2011 and Wang et al., 2017; among others). Nevertheless, in a city, taxes are constant and land price effect tend to be capture by other variables, as Figueiredo et al. (2002) suggested (*e.g.* agglomeration economies).

Finally, crime is a determinant to be taken into account, since it is proven that affects to the location of high-tech activity (Goetz and Rupasingha, 2002; Hackler, 2003). Unfortunately, this variable is used more often in US studies, due to the data availability, and leaves a lack of empirical evidence in other regions.

Thus, once seen which are the main location determinants of SVE firms, we present a set of empirical studies in which determine the high-tech or knowledge base firm's location choices (see Table 1).

[INSERT TABLE 1]

Each of the studies analyzes some of the determinants discussed above, however, there is none that analyzes all at the same time and at urban scale. Therefore, this paper analyzes all these determinants as a whole, and gives a more accurate vision of what determines the location of SVE firms within the city. In this line, we expect at urban level that:

> Hypothesis 1: *Agglomeration economies will have a positive impact on the SVE firms' entries due to the importance of networks and proximity for this industry, this impact will go beyond neighborhood borders.*

This is a basic assumption, since this industry is mainly benefits from creation of networks, input and output linkages and an improvement of the product and process innovation (e.g. see Lyons 1995, among others). Also we expect that:

> Hypothesis 2: *The impact of high-tech amenities, Cultural and creative diversity and Human Capital will have a positive impact on the SVE firms' entries while this impact will be different across type of entries (i.e. Creative and All entries). The impact of High-tech amenities and Human Capital will be higher for SVE firms' entries than for Creative and All firms' entries. Finally this impact will go beyond neighborhood borders.*

Since it is expected that amenities are important for this industry (Li and Zhu, 2017; Woodward et al., 2006), as well as cultural diversity (Florida and Gates, 2003) and this impact will differ depending on the type of firm (SVE firms, Creative firms and All firms).

3. DATA AND METHODOLOGY

3.1 Study area and Datasets

This empirical analysis focuses on location of the Software and Video games firms in the city of Barcelona at neighborhood level. This city is the second biggest city of Spain in terms of population (1.6 million inhabitants in 2016) and has a surface of 101.9 Km2.[5] Due to sea and mountains restrictions, it is a high densely populated city (more than 15,800 inhabitants per Km2). The city is divided in 10 districts and 73 neighborhoods (see Figure 1).

[INSERT FIGURE 1]

To carry out this analysis, firm and city characteristics variables were used. About firms from Barcelona city and their basic information (i.e. location and year of establishment), data comes from SABI[6] (*Sistema de Análisis de Balances Ibéricos*, INFORMA). About neighborhood characteristics, data comes mainly from the Statistical service of Barcelona city council (known as *Open Data BCN*). This database provides social, economic and demographic information of the city for several aggregation levels (city, district, neighborhood and census level).

Then, in order to identify the SVE firms and other creative activities, we used the classification by UNCTAD (2010). This classification includes all creative industries (either manufacturing or service creative industries) and is accepted by researchers (see Boix and Lazzeretti, 2012; Méndez-Ortega and Arauzo-Carod, 2018).[7] Therefore, we

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[5] Our area of study is the city of Barcelona and not its metropolitan area (which includes 35 municipalities). This is due to the lag of information for some municipalities that does not allow an analysis at metropolitan scale. Nevertheless, the city of Barcelona accounts approximately the 80% of SVE firms of the metropolitan area.

[6] SABI is a firm's database that collect information from the Spanish Mercantile Register, where all limited liability companies and corporations are obliged by law to deposit their balance sheets. Due to its coverage SABI is the most widely used database in Spain when firm georeferenciation is required.

[7] A definition of each creative industry and their respective NACE codes could be found in the annex (Table A1.)

include 17 creative sectors (of which only SVE, Advertising, Video and film and Radio and TV firms will be treated individually, and the rest jointly)[8].

[INSERT TABLE 2]

Table 2 shows some descriptive statistics of the variables used in this paper. Selected variables are in line with the economic theory of location and with the empirical evidence of high-tech firm location determinants discussed in the previous section.

3.2 Methodology

Model Specification

This empirical analysis focuses on Software and Video games firms in the city of Barcelona. To explore this, and based on the previous theoretical and empirical review on firm's location, we estimate the number of new firms in a neighborhood as a function of specific neighborhood characteristics:

$$Firm\ entries_{i(2011-2013)} = \beta_0 + \beta_{1n}AE_{in} + \beta_{2k}HTA_{ik} + \beta_{3j}CCD_{ij} + \beta_{4h}HC_{ih} + \beta_5 Crime_i + \mu_i$$

where $Firm\ entries_{i(2011\text{-}2013)}$ are the number of firms located in neighborhood *i* between 2011 and 2013, AE_{in} are Agglomeration economies in neighborhood *i* where (n = 1,…,N) are the set of these variables, HTA_{ik} are High-tech amenities in neighborhood *i* where (k = 1,…,K) are the set of these variables, CCD_{ij} are Creative and Cultural diversity in neighborhood *i* where (j = 1,…,J) are the set of these variables, HC_{ih} are Human Capital in neighborhood *i* where (h = 1,…,H) are the set of these variables and $Crime_i$ are the number of police incidents in neighborhood *i* in 2010[9].

In order to do a general comparison of firm entries, 3 different dependent variables were used (SVE firm entries, Creative firm entries and All firm entries)[10]. This allows to check differences between entry determinants between industries and it gives a more accurate

[8] The selection of these industries is accordance with Méndez-Ortega and Arauzo-Carod (2018). These are industries related to SVE industry since part of their processes are related.

[9] Land costs are included in the neoclassical economic theory of location, but we did not include in the empirical model, since taxes are the same across all neighborhoods and land price effect is captured by other variables as population density or agglomeration economies (Figueiredo et al., 2002). To test this, we found a positive and statistically significant effect of population density and education over rent prices in Barcelona (table A2.).

[10] The variable Creative firm entries do not include SVE firm entries and the variable All firm entries do not include Creative firm entries. We test to include them, but results do not change (see Robustness checks section).

information of the results, since it is possible to compare the impact of selected covariates across industries.

Model selection

With the objective of choosing a proper group of covariates to explain SVE firms' location decision, the variance inflation factor (VIF) and correlation diagnostics were applied in our model. VIF provides an index of how much higher the variance is when covariates are correlated compared to when they are uncorrelated. There is a multicollinearity problem whenever this value is higher than 10. For our subsamples, all VIF values are below 3, so we reject the possibility of multicollinearity problem. Furthermore, we test covariates correlation and most potentially correlated variables have values around 0[11].

In order to model the number of firm entries in an area, the most common models are Count Data models (CDM) (Glaser, 2017). CDM represent the number of occurrences of an event within an area in a fixed period. These models include the Negative Binomial model (NBM), the Poisson model (PM), the Zero-Inflated Binomial Model (ZIBM) or the Zero-Inflated Poisson Model (ZIPM). Then, to determine which models fit our estimation, we use the Akaike information criterion (AIC), the Bayesian information criterion (BIC) and the Vuong test as Cameron and Trivedi (2013) suggests[12].

[INSERT TABLE 3]

Descriptive statistics of the dependent variables (see Table 3) suggest that there is not an overdispersion and zero inflation problem. To test which model fits better for each situation, we estimated a baseline specification for each case using CDM and we applied the aforementioned selection tests (Table 4). These results determine that the PM performed best for SVE firms' entry specification and NBM performed best for Creative and All firms' entry specifications. Moreover, Vuong test is not statistically significant, so we reject zero-inflated models.

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[11] See correlation table in the annex (table A3.).

[12] AIC and BIC are standard measures to test which model fits better with the data. The model with the lowest AIC and BIC value is preferred over the rest of the models. The Vuong test (Vuong, 1989) tests the significance of a zero-Inflated model compared to non-zero inflated model in terms of a significant difference from zero in the overdispersion parameter. Then, a positive and statistical significant value will indicate that a zero-inflated model is preferred.

[INSERT TABLE 4]

Spatial Effects

Once we have been defined the econometric methodology, neighboring effects are also important to take into account. The results may be biased and inconsistent if the location determinants effects of firm location decisions do not come only from the geographical limits of the area (i.e. neighborhood). To take into consideration this spatial dependence, we use Moran Index (Moran, 1948) and Local Indicator of Spatial Association (Anselin, 1995) to test if there is some spatial dependence across variables. For this reason, we propose 2 spatial models to explain the effect of spatial dependence on firm location determinants: the Spatially Lagged Covariates Model (SLX) and the Spatial Autoregressive Poisson Model (P-SAR). While the SLX model considers the spatially lagged variables of the independent variables, the P-SAR model consider the spatial autoregressive lag of the dependent variable. The first, SLX model, is estimated as follows:

$$W\_K = W * K$$

where W is a row-standardized spatial neighbor matrix and K is a set of independent variables. The spatial neighbor matrix used follows the Queen Contiguity 1st order (i.e. only taking into account the nearest neighbors of 1st order). The selection of spatial lagged variables was made according to the tests mentioned above[13].

The P-SAR Model is a technique of Lambert et al. (2010) which formulate a two-step estimator for a spatial autoregressive lag model of counts. This technique allows to include the spatially lagged dependent variable into the model to explain if there is some spatial dependence effect of the dependent variable.

The first step (SAR estimation) implies to replace the spatially lagged, log-transformed counts in the y_i with their predicted values. Following Lambert et al. (2010), let the function $g(y_i)$ represent the logged-transformed values approximating neighboring counts. As it is useful to formulate the problem with reference to a log-likelihood function, the log-likelihood function of the first-stage estimator is:

[13] See variable selection according Moran Index, aspatial significance of the variable and correlation between X and WX (table A4.) and the Local Indicator of Spatial Association of selected variables (figure A5.) in the annex.

$$lnL_1 = \sum_{i=1}^{n} f_1(W \cdot g(y_i)|Q_i; \delta)$$

where $f_1$is the normal probability density function and δ a vector of parameters that maximizes L_1. Then, given a set of appropriately defined instrumental variables ($Q = [X, WX, WWX]$), the instruments regressed on the transformation yields the vector of predicted values:

$$Q\delta \text{ with } \delta = Q(Q'Q)^{-1}Q'W \cdot g\left(y_j^*\right)$$

Then, in second step, the first-stage predicted values enter in the Poisson probability density function as:

$$f(y|x, W, Q_i\delta'; \beta, \rho) = \frac{\exp(\beta' x_i + \rho \cdot Q_i'\delta)^{y_i} \exp(-\exp(\beta' x_i + \rho \cdot Q_i'\delta))}{y_i!}$$

This is essentially a Poisson regression with an endogenous covariate. We apply this procedure only to explain the spatial effect of the dependent variable of SVE firm entries, since it seems that this variable has some spatial dependence (See Figure 2) [14].

[INSERT FIGURE 2]

Unfortunately, there is a severe limitation in this technique, since it implies that all spatial dependency comes from observed covariates (Glaser, 2017). For this reason, we apply both SLX for SVE, Creative and All firm's entries and P-SAR model only for SVE firms' entries, since it is the only model which fits with SVE firms' entries and it is the industry of interest in this paper.

[14] Our estimation follows a Two-step LIML estimation. We solve the problem of zero counts transforming the dependent variable using the Inverse Hyperbolic sine transformation (Burbidge et al., 1988). For more information about the technique and procedures, see Lambert et al. (2010).

4. RESULTS

Aspatial analysis

Table 5 presents the main results without spatial effects.[15] In order to avoid multicollinearity problems, a combination of Agglomeration variables has been made (first only treating the stock of firms in the same type [i.e. Stock of SVE, Creative and All firms] and second, only using the sum stock of VFI, ADV and RTV of firms [i.e. *Aggl_10* variable]).

[INSERT TABLE 5]

For agglomeration economies, previous presence of SVE firms in the neighborhood affects positively to the present location of SVE firms, also the presence of the combination of VFI, ADV and RTV firms, which acts positively, as it is shown by Méndez-Ortega and Arauzo-Carod (2018). Apparently, the impact of Co-working spaces is not significant. For Creative and All firms' models we also found positive effect on the previous presence of their type of firms. These are expected results and fit with the previous empirical research.

Regarding the effect of high-tech amenities, all high-tech amenities variables have a positive and statistical significant impact over the SVE firm entries and almost no effect for Creative and All firm entries. This proves the important of this type of amenities for this industry (Li and Zhu, 2017; Woodward et al., 2006). It is important to highlight the positive and significant effect of the 22@ district for SVE firm entries, as Viladecans-Marsal and Arauzo-Carod (2012) proved. Cultural and creative diversity also have an impact over the SVE firm entries, the positive and significant coefficients associated to Entropy index and markets show that places with a high diversity of creative firms, street markets and diversity are places where SVE firms' choose to locate, as empirical evidence suggested (Florida and Gates, 2003; Florida and Mellander, 2016). The positive impact of these variables is slightly lower compare to creative firm entries but quite higher compare to All firm entries. The distance to *Plaça Catalunya*, which captures the distance to the cultural center of Barcelona as well as Civic Center's variable is not significant, since the location strategy of these Civic Centers is made according to poor places without much economic activity.

[15] We include Creative and all firm entries models to be able to compare the effect of some variables across type of entries, and thus have a more complete and rigorous analysis.

Human capital variables also are important for high tech firm entries decision. We found that the presence of universities affects positively on SVE firm entries decision, while a high proportion of high educated people and population density impacts positively on firm entry's decision for all models, these results fits with previous literature (Kinne and Resch, 2017). Finally, Crime affects negatively to firms' location decision on SVE firms and Creative firms, being not significant for All entries. This shows that this type of firms tend to choose safe locations where there is no crime.

Summarizing, these results fulfill the no spatial part of the hypotheses 1 and 2, finding a positive effect of Agglomeration economies, High tech amenities, Creative and Cultural Diversity and Human capital variables over SVE firm entries decision and a negative effect of Crime. But nevertheless, in order to test the second part of the hypotheses, that is, whether the impact of certain variables goes beyond the neighborhood borders, it is necessary to do a spatial analysis.

Spatial analysis (SAR-Poisson and Spatial Lag)

Table 6 presents the main results with spatial effects, the first column refers to the P-SAR model for SVE firm entries and the remaining nine columns refers to the SLX model for SVE, including spatial agglomeration variables (2), spatial high-tech amenities variables (3), spatial Creative and cultural diversity variables (4), spatial Human capital variables (5) and spatial Crime variable (6).

[INSERT TABLE 6]

For the P-SAR model, most of the key location determinant variables remain significant as in the previous estimation, the autoregressive coefficient (ρ) is statistically significant, this suggest that SVE firm neighboring entries are important and explains the SVE firm entries[16]. This effect is explained by agglomeration economies, due to the knowledge spillovers between firms, as literature and empirical evidence proved. This determinant is much more intense in SVE firms, industries in which innovation and success is very closely tied to the talents of workers (Andersson et al., 2009). The impact of high-tech amenities remains positive and significant (except for the technological science parks) as well as the effect of craft street markets.

[16] In this first estimation, previous stock of SVE firms was not consider due to the high correlation with the autoregressive component.

In the case of SLX models (2-6), almost all key location determinants consider in aspatial model remain positive and significant. In the case of lagged variables (*W_*), the presence of software firms around the neighborhood (*W_SVE_10*) affects positively to the location of SVE firms for all models, in the case of Coworking spaces, we observe that the presence of these spaces in surrounding neighborhoods affects negatively to SVE entries. For the spatial lag high tech variables, estimation (3) shows that the spatial lag variable of technological science parks affects negatively to SVE entries while the presence of these spaces in the same neighborhood affects positively to SVE entries, this suggest the capacity of these spaces to attract this type of firms, generating an "attraction effect". Also there is a positive an significant effect to SVE entries in the neighborhoods surrounding the 22@ district, due to the importance of this high tech district to attract knowledge activity (Viladecans-Marsal and Arauzo-Carod, 2012).

Moreover, in the case of the craft street markets variable, when we include the spatial lag variable, the main variable lose its positive significance and the spatial lag is negatively significance, indicating that these sort of activities attract SVE firms. Finally the spatial lag of crime and universities is not statistically significant in our SLX model.

Therefore, we totally confirm *Hypothesis 1*, since Agglomeration economies have a positive impact on SVE firms' entries and this impact go beyond neighborhood borders. In the case of *Hypothesis 2* is almost fulfilled because on the one hand, high-tech amenities and cultural and creative diversity have a positive impact on SVE firms' entries and this effect differs from that of other firm entries but, on the other hand, the effect is not significant for all the variables beyond the borders (Crime and Universities variable).

Summarizing, these results show that *i*) Agglomeration economies, high-tech amenities and cultural and creative diversity are important factors for the location of SVE firms to choose a place within the city, these effects differ when Creative and All firm entries are analyzed. *ii)* In terms of spatial effects, the SLX model shows that there is a spatial effect beyond neighborhood borders for SVE firms entries, since almost all lagged variables (*W_*) in SVE firm entries models were significant (except *crime* and Universities). Nevertheless, P-SAR model shows a spatial effect in the dependent variable (*SVE firm entries*), which indicates that there is a positive spatial autoregressive effect (SVE firm entries are affected by surrounded SVE entries at the same period).

Robustness checks

In order to give more robust results, we have carried out a series of tests to check robustness results. First, we have analyzed whether location patterns and effects of location determinants are the same for different firm sizes, we obtained similar results. Second, for the selection of spatial lagged variables, we have applied different criteria for its selection (table A4.), but we have tried to include the rest of variables and we obtain non-significant results for these variables. Third, we have use different spatial neighbor matrices (5 k-nearest neighbors' matrix, 2^{nd} order queen contiguity and median distance matrix) in order to test if the spatial effect varies. We observed that in the case of P-SAR model, the effect of the autoregressive coefficient is diluted as the matrix takes into account more neighbors (see table A6. in the annex). In the case of SLX models, we obtained similar results, being 1^{st} order Queen Contiguity matrix the best choice for both models.

5. CONCLUSIONS

This paper has analyzed which are the main location determinants of Software and Video games firms inside the city of Barcelona. This is an industry that in the last decades has changed the way in which people, firms and societies interact. Its impact in the current world economy is growing over time, what makes it one of the most important industries in the world. Despite being an industry located mainly within cities, most empirical research in location determinants of high-tech firms has been done at regional or country level.

That is why this paper has contributed to the literature filling the lack of empirical evidence having analyzed location determinants of this industry at urban level, dealing with factors that either had not been taken into account, or had not been analyzed together at this scale. Our main results showed that SVE firms tend to choose locations with good high-tech amenities, high diversity of creative firms and places with presence of SVE firms and other similar type of firms (i.e. Agglomeration Economies). Our hypothesis were met since we found a positive effect of Agglomeration economies, High tech amenities, Creative and Cultural Diversity and Human capital variables over SVE firm entries decision and a negative effect of Crime. The methodological approach used in this paper supposes an improvement in the knowledge of the location strategies of these firms and complements previous contributions with a methodology rarely used in empirical studies due to its complexity.

Accordingly, these results rise to some interesting suggestions for policy makers. Until now, it was mainly taken into account that SVE firms were located in places with technological facilities, human capital and good infrastructures in general. This paper has shown that not only these characteristics are important, but also cultural and creative diversity are very important for the location and development of this industry inside a city. These considerations can be extended to other cities. Hence, promotion and attraction of creative activities, jointly with previous factors mentioned before, will contribute to the location of SVE activities, activities with a high economic growth that will boost the economic development and growth of cities.

Nevertheless, this paper has some limitations that we intend to address in further research. Although the unit of analysis is small (i.e. neighborhood), it has to be taken into account that there is a modifiable areal unit problem (MAUP). The paper corresponds to a specific city and period of time. Further research should explore all these concerns in other to provide more robust results.

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TABLES:

Table 1. Summary of recent location studies about High-tech, Knowledge Base and/or SVE firms.

Studies	*LAE*	*HTA*	*CCD*	*HC*	*LPT*	*C*
Abramovsky and Simpson (2011)	X	X		X		
Acosta et al. (2011)	X	X		X	X	
Audretsch and Lehmann (2005)	X	X		X		
Audretsch and Keilbach (2004)		X		X		
Chatman and Noland (2011)	X	X		X		
Marra et al. (2017)	X					
Florida and Mellander (2016)	X	X	X	X		
Florida and Mellander (2009)				X	X	
Goetz and Rupasingha (2002)	X			X	X	X
Hackler (2003)	X	X		X		X
Kinne and Resch (2017)	X	X		X	X	X
Li and Zhu (2017)	X	X		X		
Li et al. (2016)	X			X	X	
Méndez-Ortega and Arauzo-Carod (2018)	X	X	X			
Viladecans-Marsal and Arauzo-Carod (2012)	X	X		X		
Wang et al. (2017)	X	X			X	
Wood and Dovey (2015)	X		X	X	X	
Woodward et al. (2006)	X	X		X	X	
Zandiatashbar and Hamidi (2018)	X	X	X	X		

Source: Author. Note: *LAE* (Localization and Agglomeration Economies), *HTA* (High-Tech Amenities), *CCD* (Cultural and Creative Diversity), *HC* (Human Capital), *LPT* (Land Price and Tax) and *C* (Crime).

Table 2. Descriptive statistics of the Covariates by neighborhood.

Acronym	Description	Expected effect	Source	Mean	Standard Desviation	Max	Min
Agglomeration economies							
Loc_10(SVE)	Stock of SVE firms in 2010	+	SABI	23.232	44.587	283	0
Loc_10(Cre)	Stock of Creative firms in 2010	+	SABI	106.689	187.007	1075	0
Loc_10 (all)	Stock of all firms in 2010	+	SABI	866.698	1599.765	9552	8
Aggl_10	Stock of VFI, ADV and RTV firms in 2010	+	SABI	31.041	64.203	378	0
Cowork	Log of the number of coworking spaces (private)	+	OE	0.807	1.066	4.061	0
	High-tech Amenities						
Wifi	Nº of Wi-fi Hotspots in the neighbourhood	+	OD-BCN	8.096	10.443	56	0
CTP	Nº of Scientific and Technological parks	?	OE	0.110	0.315	1	0
Dist22	Dummy var. (value 1 whether the neighbourhood belongs to 22@)	+	OE	0.0548	0.229	1	0
	Diversity						
Dist_centre	Distance to the CBD and Cultural centre (*Plaça Catalunya*) in metres	?	OE	4244	1944	8779	697.7
*Ent_f**	Entropy index of Creative firms in 2010	+	OE	0.675	0.202	0.880	0
Markets	Nº of Craft street Markets in 2010	?	OD-BCN	1.342	1.988	12	0
CC	Nº of Civic centres in 2010	+	OD-BCN	0.671	0.746	3	0
	Human Capital						
Uni	Nº of Universities (Faculties) in 2010	+	OE	0.808	1.838	11	0
EDU_10	Proportion of high educated population in 2010	+	OD-BCN	0.213	0.121	0.497	0.022
PD_10	Population density (pop. per residential surface) in 2010	+	OD-BCN	692.962	305.875	1504	30.054
	Crime						
Crime_rat	Nº of Police incidents per 1000 hab.	-	OD-BCN	2.334	2.488	14.90	0.0650

Note: OE (Own Elaboration), OD-BCN (Open Data Barcelona). (*) This index is an indicator of equality (Theil, 1974) which ranges between 0 and 1 to detect whether a spatial unit is homogeneous or diverse, in our case we apply this index to the diversity of creative firms in the area (i.e. neighborhood).

Table 3. Descriptive statistics of dependent variables

Acronym	Description	Mean	Standard Deviation	Max	Min	% of Zeros
Sve_ent	SVE firm's entries 2011-2013	4.479	8.386	44	0	32.87
Cre_ent	Creative firm's entries 2011-2013	16.082	29.254	167	0	19.17
All_ent	All firm's entries 2011-2013	92.671	175.980	1127	0	2.73

Source: Author.

Table 4. Selection model's tests.

	AIC	BIC	Vuong Test
Model 1 (SVE firms)			
Poisson	286.349	320.706	-
Negative Binomial	302.665	334.732	-
Zero-inflated Poisson	290.021	328.959	0.526
Zero-inflated negative binomial	304.513	341.161	0.205
Model 2 (Creative firms)			
Poisson	415.352	447.136	-
Negative Binomial	392.779	427.136	-
Zero-inflated Poisson	414.131	450.778	0.731
Zero-inflated negative binomial	396.779	435.717	-0.149
Model 3 (All firms)			
Poisson	1188.898	1220.964	-
Negative Binomial	663.867	698.224	-
Zero-inflated Poisson	1172.139	1208.7871	1.296
Zero-inflated negative binomial	656.856	695.794	1.183

Source: Author.

Table 5. Location determinants of firms (Aspatial).

	Software and Video games firms		Creative Firms	All firms
	PM		NBM	NBM
	(1)	(2)	(3)	(4)
Agglomeration Economies				
Loc_10	0.00787***		0.00193***	0.000293***
	(0.00148)		(0.000367)	(6.11e-05)
Aggl_10		0.00592***		
		(0.00102)		
Cowork	0.0475	-0.0159	0.125	0.119
	(0.147)	(0.147)	(0.113)	(0.128)
High-Tech Amenities				
Wifi	0.0211**	0.0296***	0.00986	0.0231**
	(0.00943)	(0.00850)	(0.00772)	(0.0111)
CTP	0.410*	0.620***	0.137	0.959***
	(0.235)	(0.236)	(0.221)	(0.270)
Dist_22	0.883***	0.853***	0.287	-0.343
	(0.301)	(0.301)	(0.270)	(0.330)
Cultural and Creative Diversity				
Entropy	3.483***	3.476***	6.977***	2.881***
	(1.351)	(1.306)	(1.271)	(0.554)
Markets	0.106***	0.135***	0.0759***	0.0889**
	(0.0328)	(0.0342)	(0.0274)	(0.0400)
CC	-0.0381	-0.131	0.0405	-0.0571
	(0.0976)	(0.0955)	(0.0759)	(0.0907)
Dist_centre	3.79e-05	1.77e-05	-2.94e-06	5.14e-05
	(8.74e-05)	(8.64e-05)	(7.40e-05)	(7.06e-05)
Human Capital				
Uni	0.0607**	0.0563**	0.0374	-0.0221
	(0.0274)	(0.0274)	(0.0287)	(0.0419)
Edu_2010	5.214***	4.574***	4.854***	2.559***
	(1.264)	(1.267)	(1.029)	(0.903)
PopD_2010	0.00104***	0.00102***	0.000751**	0.000655**
	(0.000393)	(0.000389)	(0.000334)	(0.000309)
Crime				
Pol_rat	-0.112**	-0.140**	-0.0799*	-0.0135
	(0.0544)	(0.0548)	(0.0415)	(0.0536)
Constant	-4.237***	-3.924***	-5.608***	-0.297
	(1.286)	(1.244)	(1.186)	(0.734)
Observations	73	73	73	73
Non-zero observations	49	49	59	71
LR chi2	570	576.2	154.4	152.8
Log likelihood	-137.3	-134.2	-159.3	-309.4
Pseudo R-squared	0.675	0.682	0.327	0.198
/ln alpha			-3.124***	-1.501***
			(0.676)	(0.207)
alpha			0.0440	0.223

VIF	2.92	2.87	2.91	2.89

Note: Standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. Note: Loc_10 refers to stock of the current type of firms in 2010. Poisson Model (PM), Negative Binomial Model (NBM).

Table 6. Location determinants of firms (P-SAR and SLX Models).

	Software and Video games firms					
	P-SAR			**SLX**		
	(1)	(2)	(3)	(4)	(5)	(6)
Agglomeration Economies						
SVE_10		0.00817***	0.00884***	0.0109***	0.01053***	0.0125***
		(0.00146)	(0.00169)	(0.00183)	(0.00208)	(0.00222)
Cowork	0.00820	0.0804	0.0517	-0.123	-0.125	-0.199
	(0.143)	(0.150)	(0.156)	(0.158)	(0.160)	(0.169)
High-Tech Amenities						
Wifi	0.0450***	0.0172*	0.00838	0.00899	0.01338	0.00787
	(0.00826)	(0.0101)	(0.0109)	(0.0109)	(0.0115)	(0.0114)
CTP	0.317	0.745***	0.719**	1.357***	1.338***	1.875***
	(0.244)	(0.279)	(0.309)	(0.369)	(0.370)	(0.539)
Dist_22	0.965***	0.924***	0.574	0.376	0.373	0.366
	(0.302)	(0.299)	(0.361)	(0.382)	(0.384)	(0.397)
Cultural and Creative Diversity						
Entropy	1.807	3.475***	4.126***	3.318**	3.448**	3.450**
	(1.204)	(1.321)	(1.448)	(1.418)	(1.414)	(1.409)
Markets	0.0792**	0.0823**	0.106***	0.00147	0.02284	-0.00301
	(0.0352)	(0.0333)	(0.0356)	(0.0472)	(0.0504)	(0.0505)
CC	-0.167*	-0.0982	0.0409	0.0212	0.0545	-0.0310
	(0.0944)	(0.100)	(0.108)	(0.107)	(0.107)	(0.115)
Dist_centre	-4.32e-06	7.81e-05	8.81e-05	-4.56e-05	-6.06e-06	2.07e-05
	(0.000105)	(0.000104)	(0.000107)	(0.000114)	(0.000114)	(0.000129)
Human Capital						
Uni	0.0899***	-0.0146	-0.0100	-0.0609	-0.0578	-0.145*
	(0.0283)	(0.0380)	(0.0425)	(0.0459)	(0.0716)	(0.0785)
Edu_2010	5.385***	4.447***	4.550***	4.477***	4.367***	5.121***
	(1.614)	(1.292)	(1.547)	(1.651)	(1.638)	(1.792)
PopD_2010	0.000565	0.000921**	0.000720*	0.000516	0.000611	0.000476
	(0.000424)	(0.000403)	(0.000425)	(0.000453)	(0.000447)	(0.000450)
Crime						
Pol_rat	-0.0745	-0.0693	-0.0244	0.0663	0.0303	0.0712
	(0.0503)	(0.0563)	(0.0581)	(0.0674)	(0.0650)	(0.0682)
Spatial Variables						
ρ	0.0922**					
	(0.0766)					
w_SVE_10		0.0135***	0.0164***	0.0287***	0.0256***	0.0423***
		(0.00465)	(0.00563)	(0.00648)	(0.00875)	(0.0127)
w_Cowork		-0.107**	-0.140**	-0.227***	-0.265**	-0.378**
		(0.0501)	(0.0582)	(0.0623)	(0.109)	(0.148)
w_CTP			-1.594***	-0.765	-0.670	0.532

			(0.588)	(0.612)	(1.047)	(1.154)
w_Dist_22			1.573***	1.509***	1.492***	1.558***
			(0.443)	(0.452)	(0.466)	(0.473)
w_Markets				-0.439***	-0.377***	-0.532***
				(0.120)	(0.117)	(0.190)
w_Uni					-0.059	-0.280
					(0.180)	(0.211)
w_Pol_rat						0.162
						(0.211)
$\boldsymbol{\theta}$	0.338**					
	(0.156)					
Constant	-2.934**	-4.277***	-4.815***	-3.074**	-3.444**	-3.670**
	(1.181)	(1.301)	(1.410)	(1.413)	(1.501)	(1.543)
Observations	73	73	73	73	73	73
Non-zero observations	49	49	49	49	49	49
LR chi2	542.1	578.5	596.3	611.2	606.0	612.9
Log likelihood	-151.3	-133.1	-124.2	-116.7	-119.3	-115.9
Pseudo R-squared	0.672	0.685	0.706	0.724	0.717	0.726

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

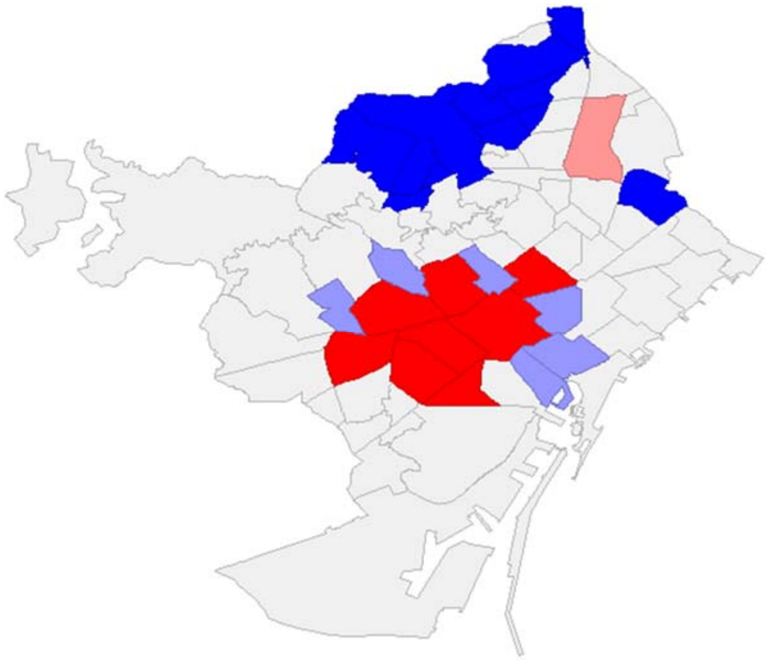
FIGURES:

Figure 1. City of Barcelona by neighbourhoods (73)

Source: Barcelona Statistics Service (www.bcn.cat/estadistica)

Figure 2. **Local indicator of spatial association (LISA) and Moran Index for SVE firms' entries.**

SVE_ent **(0.373)**



Source: Author. Note: Moran index in brackets. Red colour means neighbourhoods with a high value surrounded by neighbourhoods with high value, red off means neighbourhoods with a high value surrounded by neighbourhood with low value, blue off means neighbourhoods with a low value surrounded by neighbourhood with high value and blue means neighbourhoods with a low value surrounded by neighbourhoods with low value. Results after 999 permutations.

ANNEX:

Table A1: List of creative industries classification

Nº	Creative industries	Acronym	NACE 2009 Codes
1	Advertising and related services	ADV	731
2	Architecture and engineering	AE	711
3	Art and antiques trade	ART	4779
4	Craft and Performing Arts	CPA	90
5	Cultural Tourism and Recreational Services	TRS	93
6	Publishing	ED	581
7	Fashion	FA	14, 1511, 152
8	Graphic arts	GA	181
9	Heritage, cultural sites and recreational services	HE	91
10	Creative research and development	IDC	721, 722
11	Jewellery, musical instruments, toys and games	JEW	321, 322, 324
12	Music and music studies	MU	182, 592
13	Photography	PHO	742
14	Radio and TV	RTV	601, 602
15	Software, video games and editing electronics	SVE	620, 582
16	Specialised services design	SSD	741
17	Video and film industries	VFI	591

Source: Compiled by the author based on UNCTAD (2010)

Table A2: Determinants of rent price in Barcelona by neighbourhood (2011).

	Rent Price			
	SVE Firms		Creative Firms	All Firms
	(1)	(2)	(3)	(4)
Loc_10	-0.00926*		-0.00197	-0.000209
	(0.00475)		(0.00119)	(0.000129)
Aggl_10		-0.00519		
		(0.00327)		
Cowork	-0.380	-0.367	-0.347	-0.407
	(0.257)	(0.262)	(0.263)	(0.259)
Wifi	0.00281	-0.00782	-0.00674	-0.00426
	(0.0255)	(0.0239)	(0.0239)	(0.0249)
CTP	0.379	0.326	0.354	0.372
	(0.534)	(0.540)	(0.538)	(0.539)
Dist_22	0.487	0.505	0.495	0.401
	(0.620)	(0.626)	(0.625)	(0.630)
Ent_f	-0.590	-0.619	-0.582	-0.548
	(0.977)	(0.988)	(0.985)	(0.986)
Markets	0.0199	0.00621	0.0124	0.0215
	(0.0819)	(0.0833)	(0.0828)	(0.0827)
CC	0.0435	0.0802	0.0751	0.0790
	(0.188)	(0.188)	(0.188)	(0.188)
Dist_centre	-0.000156	-0.000149	-0.000142	-0.000142
	(0.000132)	(0.000133)	(0.000133)	(0.000133)
Uni	0.0225	0.0149	0.0142	0.0155
	(0.0901)	(0.0908)	(0.0905)	(0.0908)
Edu_2010	15.79***	15.88***	16.04***	15.91***
	(2.024)	(2.054)	(2.063)	(2.054)
PopD_2010	0.00146**	0.00145**	0.00148**	0.00148**
	(0.000568)	(0.000576)	(0.000573)	(0.000573)
Pol_rat	0.102	0.124	0.124	0.119
	(0.105)	(0.105)	(0.105)	(0.105)
Constant	6.288***	6.241***	6.150***	6.152***
	(1.306)	(1.320)	(1.318)	(1.320)
Observations	73	73	73	73
R-squared	0.768	0.763	0.764	0.763

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table A3: Correlation Matrix

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)	***Cowork***	1											
(2)	***Wifi***	0.765*	1										
(3)	***CTP***	0.104	-0.096	1									
(4)	***Dist_22***	0.159	0.096	0.108	1								
(5)	***Ent_f***	0.487*	0.412*	0.066	0.133	1							
(6)	***Markets***	0.322*	0.346*	-0.083	-0.042	0.223	1						
(7)	***CC***	0.288*	0.316*	0.037	0.026	0.326*	0.245*	1					
(8)	***Dist_centre***	-0.689*	-0.619*	-0.096	-0.071	-0.694	-0.315	-0.199	1				
(9)	***Uni***	0.278*	0.162	0.517*	-0.008	0.206	0.052	0.186	-0.188	1			
(10)	***Edu_2010***	0.630*	0.475*	0.099	-0.065	0.583*	0.138	0.217	-0.593*	0.385*	1		
(11)	***Popd_2010***	-0.010	0.073	-0.234*	0.211	0.208	0.114	0.042	-0.287*	-0.137	-0.252*	1	
(12)	***Pol_rat***	0.712*	0.664*	0.081	-0.017	0.448*	0.607*	0.295*	-0.642*	0.190	0.307	0.174	1

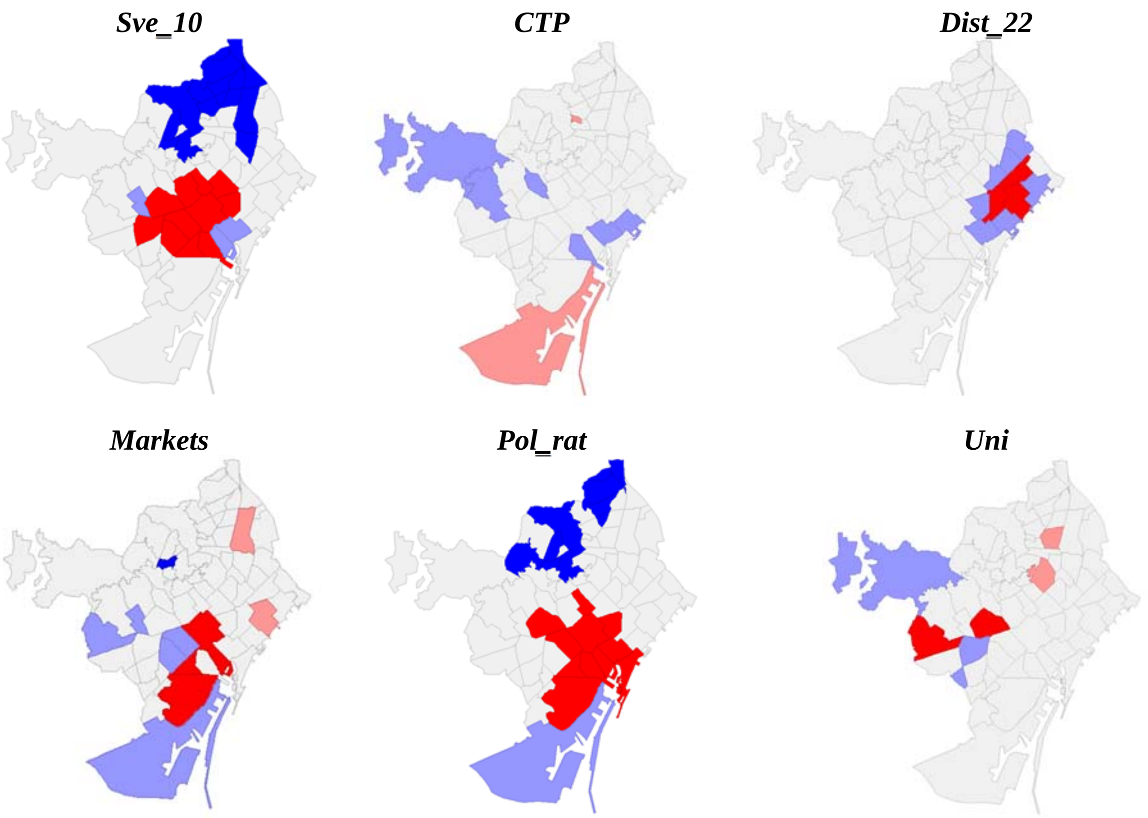
Source: Author. Note: (*) Significance level at 5%.

Table A4. Selection of Spatial Lag variables (SLX Model)

Variable	Correlation with WX	Moran I	Sig. Aspatial	SLX Model
SVE_10	0.574*	0.406	Yes	Yes
cowork2	0.680*	0.538	No	No
wifi	0.618*	0.447	Yes	No
ctp	0.134	0.060	Yes	Yes
dist_22	0.472*	0.343	Yes	Yes
ent_f	0.739*	0.566	Yes	No
markets	0.089*	0.046	Yes	Yes
cc	-0.020	-0.011	No	No
dist_centre	-	-		No
Pol_rat	0.668*	0.478	Yes	Yes
uni	0.291*	0.143	Yes	Yes
edu_2010	0.841*	0.681	Yes	No
popd_2010	0.385*	0.240	Yes	No

Source: Author. Note: Sig. Aspatial indicates whether this variable was significant in the aspatial model.

Figure A5. Local indicator of spatial association (LISA) for SLX model selected variables.



Source: Author.

Table A6. Neighbour matrices test for P-SAR model

W matrix	(1) 1st Order Queen Contiguity	(2) 5-k nearest neighbors	(3) 2nd Order Queen Contiguity	(4) Median distance
ρ	0.0922**	0.0902*	-0.0830	-0.118
	(0.0766)	(0.0611)	(0.108)	(0.0795)
Constant	-2.934**	-3.171***	-2.312*	-2.272*
	(1.181)	(1.225)	(1.256)	(1.199)
θ	0.338**	0.371**	0.194	0.200
	(0.156)	(0.166)	(0.183)	(0.161)
AE var.	Yes	Yes	Yes	Yes
HTA var.	Yes	Yes	Yes	Yes
CCD var.	Yes	Yes	Yes	Yes
HC var.	Yes	Yes	Yes	Yes
Crime var.	Yes	Yes	Yes	Yes
Observations	73	73	73	73
Non-zero observations	49	49	49	49
LR chi2	542.1	541.8	540.2	541.4
Log likelihood	-151.3	-152.1	-153.7	-154.1
Pseudo R-squared	0.672	0.643	0.641	0.643

Standard errors in parentheses. Notation: *** p<0.01, ** p<0.05, * p<0.1. Note: This table only shows main results; the rest of the results are available upon request.