Sustainability, local environmental policies and firm location decisions

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Abstract:

This paper analyses location determinants of firms at municipality level focusing on role played by local environmental policies in shaping these decisions. The contribution to empirical literature is the identification of specific locational patterns driving decisions of firms depending on their sustainability profile. Unfortunately, the effect of locally-oriented sustainable policies (e.g., sustainable practices in waste collection) over firms' location decisions has received considerably lower attention by researchers, and their effects in terms of attracting new firms, if any, are less evident. In this paper, the focus is not on the effects of environmental policies over firms' operational costs, but on the social perception of sustainability issues, which is proxied by local policies such as waste collection. The idea behind this approach is that these policies mirror social attitudes (i.e., that are measurable at municipality level) that may attract / repeal certain activities. This is accomplished by using Mercantile Register data for new firm entries in Catalan municipalities between 2004 and 2014. Overall, our results show that i) there is a clear agglomeration of entries in and around main metropolitan areas, especially in Barcelona; ii) although during the period analysed the sustainability profile of entries is quite steady, location shares of firms from less sustainable industries slightly decrease, iii) industry specialisation patterns from a spatial point of view are unclear; iv) even if local clusters of entries at industry level are so scarce, there are some geographical regularities that indicate common entry patterns for areas larger than municipalities; and v) there are some areas (noticeably at the metropolitan area of Reus-Tarragona) where clustering of entries increases at the same time that it decreases at the metropolitan area of Barcelona, no matter the industry. There are some policy implications arising from previous results, as they show that structural changes towards more sustainable activities are very slow, only partially clustered, and do require specific policy actions in order to boost the process, which suggests that additional public efforts have to be implemented in order to transform industry composition of new entrants towards a stronger sustainable profile.

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JEL codes: R10, R30, Q01, Q53, Q56

1. Introduction

Environmental policies are a growing concern for policy makers, and they affect a wide range of public dimensions. Apart from the role public regulations play in terms of shaping technologies and production processes carried out by firms, these regulations also matter in terms of the location and relocation of economic activities. There is a considerable literature on the effects of environmental regulations on Foreign Direct Investment (FDI), since multinational firms move across different geographical areas in order to avoid increasingly strict environmental regulations (List and Co, 2000). A non-negligible proportion of offshoring / backshoring decisions are driven by such environmental concerns, but such a framework for the worldwide geographical mobility of firms is no longer useful when we are dealing with smaller areas with homogeneous environmental regulations.

This paper deals with the micro-location situation, municipalities of the same country sharing a homogeneous institutional framework, but that have some specificities in the implementation of local environmental policies, a circumstance easily explained by the scarcity of local attributions on that issue. In these cases, the switch to environmental-friendly activities is not only explained by (local) policy decisions (also triggered by social preferences at the local level), but also by spatial asymmetries at the industry level that act as location determinants by favouring some activities over others.

Firms' location determinants have received increased attention in recent years in view of the positive impact of entering firms on job creation and GDP expansion. These empirical contributions have considered internal and/or external location determinants, but in this paper, we focus on the latter.[1] Concretely, we analyse the role played by characteristics of the areas where firms locate or may locate. Specifically, we assume that *i)* firms are not neutral to alternative sites / areas that differ in their potential revenues, that *ii)* firms from different industries are shaped in a different way by local characteristics (*i.e.*, they have different requirements in terms of the characteristics of the areas where they locate), and that *iii*) there are differences in social perception towards sustainability that shape local public policies. Unsurprisingly, these issues have been much analysed in the empirical literature, and there are many papers dealing with how the local characteristics of the main determinants (agglomeration economies, transport infrastructures, human capital, wages and institutions), shape these decisions. Since this have been widely discussed, we do not attempt to go further in that direction but explore a new path that has hitherto received less attention, that of sustainable entries (Colombelli and Quatraro, 2019) and the (increasing) role played by sustainability issues in location decisions (Chen *et al*., 2014). Concretely, we refer to the way in which the sustainability dimension, and changing social attitudes towards it in developed countries, may boost firm creation and location in these industries. In this sense, not all territories have the same capacity to attract new firms, and not all firms that locate are looking for similar areas.

Nowadays, sustainability is on the agenda of developed country policy makers operating at different administrative levels. This applies to *i)* national governments, interested in the promotion of a sectorial transition towards greener industries and in the overall reduction of emissions from economic activities; and to *ii)* regional and local governments mainly interested in the attraction of environmentally friendly activities. Nevertheless, as already mentioned, these policies tend to be quite homogeneous at the local level (city councils must fit into the same regulatory framework), so they cannot be hypothesized as having a key role in firms' decisions if these are among alternative municipalities of the same institutional area (*e.g.*, countries or regions). In view of rising awareness and sensitivity regarding climate change and its consequences (Meek *et al.*, 2010), environmental concerns are increasingly shared by firms aiming to contribute to social welfare in terms of sustainability (Bansal and Roth, 2000). Further, there is empirical evidence suggesting that social norms related to environmental issues may affect the entry of environmentally responsible new firms (Meek *et al.*, 2010). We hypothesize that local policies not directly related to environmental requirements for firms operating in these areas (but related in general terms to environmental values) may have indirect effects on firms' decisions such as, for instance, location ones (De Silva *et al*., 2017).

A review of the empirical literature regarding the location patterns of new firms (see Arauzo-Carod *et al*., 2010, for a detailed analysis) shows, among its main findings, that they *i)* agglomerate in certain core areas

[1] Readers interested in internal location determinants should check business-oriented papers dealing with characteristics such size and industry, among others, that may (partially) explain why, when, where, and how firms enter markets (Fotopoulos and Spence, 1998).

especially national or regional capitals, *ii)* look for accessible areas in order to minimise transport costs, *iii)* seek specialised labour pools, *iv)* prefer to be close to the areas where main public institutions are already located, and *v)* are positively influenced by the location decisions of previous entrants. Nevertheless, these location patterns are not homogeneously shared by all type of firms—depending on the industry, the preferred territories may vary. This is easily explained by the fact that these characteristics (in terms of infrastructure, wages, labour availability, accessibility, etc.) are not homogenously distributed across regions or cities. In consequence, depending on whether territories specialise in certain activities and firms from different industries require a different profile of social and economic conditions, the matching between each firm and chosen area will depend on the characteristics of both the firms and the areas.

Most empirical contributions on sustainability issues and firms' location determinants focus on the "pollution haven" hypothesis, which suggests that firms try to avoid strict environmental regulations which push up their production costs and, in consequence, locate in areas with laxer environmental norms. This hypothesis is (roughly) supported by empirical evidence from, among others, Lin and Sun (2016) for provinces in China, Chung (2014) at country level, List and Co (2000) for U.S. states, and List and McHone (2000) for New York State.[2] Nevertheless, there are other papers (*e.g.*, Wang *et al*., 2019) concluding that the opposite hypothesis (*i.e.*, Porter hypothesis) is true, suggesting that stricter environmental regulations provide incentives to increase a firm's efficiency.

Unfortunately, the effect of locally oriented sustainable policies (*e.g.*, sustainable practices in waste collection) over location decisions has received considerably less attention from researchers, and the effects, if any, of such policies in attracting new firms are less evident. In this paper, the focus is not the effects of environmental policies on operational costs, but on the social perception of sustainability issues, which is proxied by local policies such as waste collection. The idea behind this approach is that these policies mirror social attitudes that are measurable at municipality level which may attract / repel certain activities. So, if there are public policies promoting sustainable oriented practices, the areas in which these policies are being implemented may be attractive to firms in sustainable-oriented industries, even if these policies are not directly related to firms' activities. This is a key issue in terms of policy implications, as most of the literature concerns policies at levels larger than that of the municipality.

Based on these considerations, we formulate the following hypotheses:

- Hypothesis 1: Territories differ in their capacity to attract new firms.
- Hypothesis 2: Industries differ in their locational preferences.
- Hypothesis 3: Territories concerned about sustainability issues are better positioned to attract firms from sustainable industries.

The rest of this paper is organised in the following way: Section 2 details data sources, industry classification and empirical methodology, Section 3 discusses main results, and Section 4 concludes and provides some policy recommendations.

2. Empirical framework

2.1 Data sources

The data in this paper are from Catalonia, an autonomous region in north-eastern Spain whose capital is Barcelona. This is a dynamic area in terms of the entry of new firms, although most of them cluster around the main metropolitan areas,[3] especially that of Barcelona.

Data on firm locations are provided by the *Sistema de Análisis de Balances Ibéricos* (henceforth SABI), compiled by INFORMA D&B and by Bureau Van Dijk which contains data from the Spanish Mercantile Register. The SABI dataset contains exhaustive information at the 4-digit level on balance sheets at the firm level and has been extensively used for location analyses by many scholars. This dataset includes detailed information at the firm level on, inter alia, location, number of employees, legal status and sales.

[2] Jeppesen *et al*. (2002) provide a broader view using a meta-analysis technique.

[3] Catalonia has about 7.7 million inhabitants (16% of Spain's population) and a surface area of 31,895 km^2. It accounts for 20% of Spanish GDP.

Data on territorial characteristics come from different sources. The main one is the Waste Agency of Catalonia, the public body charged with waste management in Catalonia. Additional data come from the Catalan Statistical Institute (IDESCAT), which provides information about population, income and employment at a local level, and the Catalan Cartographical and Geological Institute (ICGC), which provides information about the geographical location of municipalities.

2.3 Industry classification

Before analysing location patterns of firms at the industry level, it is necessary to provide a methodological approach as to what is considered as a sustainable industry. There are three main constraints: the first is that we do not have data at the product level, but only at the industry level for each firm; the second is that we rely on the NACE 3-digit classification (which is quite broad) provided by Spanish Mercantile Register; and the third is that there is no an "official" classification of sustainability to follow. These limitations imply that *i)* we will only proxy sustainability in terms of the main industry in which firms choose to be registered, taking into account neither specific technologies or production processes used by these firms, nor any individual actions undertaken to ensure a sustainable behaviour; and that *ii)* our results are sensitive to our measure of sustainability (*i.e.*, there is a potential bias).

In this paper, our starting point is the Central Pollution Control Board classification (CPCB, 2016) which groups industries in terms of their environmental sustainability. The purpose of that classification is to analyse the industry environmental effects (*e.g.*, consumption of resources) in order to take public decisions regarding the location of plants from these industries. Concretely, for each industry a pollution index ranging between 0 and 100 is calculated by CPCB and each industry is classified as red (score 60–100), orange (41–59), green (21–40) or white (0–20).

[INSERT TABLE A.1 ABOUT HERE]

As the industry classification was slightly different than the NACE 3-digit used in this study we adapted that classification (see Table A.1 in the Appendix) and, for the sake of comprehension, renamed the above groups in terms of their sustainability profile as LOW (red), LOWMED (orange), MEDHIGH (green) and HIGH (white).[4]

Needless to say, alternative sources for an industry classification of sustainability could be found, for example, studies that analyse emissions at industry level (Hettige *et al.*, 1995) or those that consider the amount of energy required to provide a unit of output (Eskeland and Harrison, 2003; Kahn, 2003), but we consider that the current choice allows us to strike a reasonable balance between industry disaggregation and coverage.

2.3 Methodology

In order to analyse firm location determinants, we estimate the number of new firms at a local level as function of several local characteristics as shown here:

$$Location_{ijt} = \beta_0 + \beta_1 WASTE_{ijt-1} + \beta_2 POP_{ijt-1} + \beta_3 INCOME_{ijt-1} + \beta_4 UNE_{ijt-1} + \beta_5 SELF\_MAN_{ijt-1} + \beta_6 POP\_JOBS_{ijt-1} + \beta_7 POPC_{ijt-1} + \varepsilon_{ijt}$$

where $Location_{ijt}$ is the number of new firms of industry *j* located in municipality *i* in year *t*, and $WASTE_{ijt}$, POP_{ijt}, $INCOME_{ijt}$, UNE_{ijt}, $SELF\_MAN_{ijt}$, POP_JOBS_{ijt} and $POPC_{ijt}$ are vectors of the variables hypothesized to determine location decisions (see Table 1 for a description of these variables). In a second stage, spatially lagged versions of most of previous covariates are also included (W_WASTE_{ijt},W_POP_{ijt},W_INCOME_{ijt},$W_UNE_{ijt}$and $W\_SELF\_MAN_{ijt}$).[5]

[4] As this typology from CPCB (2016) was established after the end of the period analysed, there are no endogeneity problems such as municipalities trying to attract firms belonging to sustainable industries.

[5] The W-matrix used for spatial lags calculation is a row-standardized one for which neighbourhood criterion is a distance-based one. Concretely, we use the minimum distance (11.2 km) to ensure that all municipalities have at least 1 neighbour. The minimum number of neighbours is thus 1 and the maximum is 34 (mean = 13.9). Additionally, alternative W-matrixes have been tested without significant changes. For

The empirical strategy consists in estimating the same model for the four industry types considered in order to identify whether sustainability-oriented policies may influence location patterns.

[INSERT TABLE 1 ABOUT HERE]

As there is no available data for local environmental policies, using data from waste sorting (WASTE) appears to be a good proxy for local support for sustainability issues.[6] Waste regulations in Catalonia started in 1993 with a law targeting mainly industrial waste,[7] but in 1995 the Catalan government developed the Waste Local Management Program, that boosted waste sorting at the local level, although with important heterogeneities across municipalities, as local units can decide their commitment levels in terms of the type of wastes to be sorted. Nevertheless, WASTE not only proxies commitment of city councils, as waste sorting needs both, the city council providing the appropriate infrastructure, but also citizenship collaboration by sorting their own waste. Figure 1 shows the noticeable improvements in terms of waste sorting at local level between 2003 and 2013.

[INSERT FIGURE 1 ABOUT HERE]

According to the characteristics of our dependent variable (i.e., number of entries by municipality) the most appropriate econometric methodology are Count Data (CD) specifications. The Poisson distribution of the dependent variable suggests using CD specifications, as many location analyses already do (see, for instance, Arauzo-Carod *et al*., 2010, for a review of that literature and Becker *et al*., 2012, and Wang *et al*., 2019, for some empirical applications).

Count data are especially useful if the events being analysed (*i.e.*, the number of entries) are recorded at a highly disaggregated geographical level (*e.g.*, municipalities), as in this paper, where 946 municipalities are used, some of them being very small and without entries for the whole period (technically this is known as the 'zero problem'). As a matter of fact, the methodology can deal with this problem, although there are important differences in terms of the specific model to be used depending, among other issues, on the number of zeroes. In technical terms, the existence of such zeroes is relevant because municipalities where there are no entries provide useful information in understanding location patterns.

In this paper, we assume that the count of entries at municipality level has a random Poisson distribution in which the parameter λ_i is related to the regressor vector x_i that measures site characteristics. Concretely, we assume that the probability of entries depends on the specific characteristics of municipalities:

$$Pr(y_i|x_i) = \frac{e^{-\lambda_i}\lambda^{y_i}}{y_i!}, y_i = 0, 1, 2, \dots, n$$

where λ_i is dependent on the vector of explanatory variables (municipality characteristics including vectors for agglomeration economies, labour market and environment):

$$\ln \lambda_i = \beta' x_i$$

and β denotes a vector of coefficients of explanatory variables to be estimated.

If we depart from the most popular specification of CD, the Poisson specification, there are two restrictive assumptions to be made. The Poisson specification implies that the mean and the variance should be equal, which would be violated when firm location decisions are clustered in some municipalities (*i.e.*, overdispersion). Concretely, overdispersion is explained in terms of unobserved heterogeneity in the mean function. This is easily solved by using a Negative Binomial specification (NB), which allows the variance to be larger than the mean. The second one is in regard to the 'zero problem'. Poisson specifications can deal with situations with many zeroes, but an excessive number requires us to use an NB.

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the sake of estimation simplicity and trying to focus on the variables with a clear spatial dimension, we decided not to include spatially lagged versions of POP_JOBS and POPC. In this sense, population data was already included in POP and W_POP variables.

[6] Alternative measures could include manufacturing and construction waste management plants, but using that information has several limitations, as these plants are a mixture of private / public property, they do not directly serve municipalities (as firms may choose which one to use) and available data does not include activity records on a yearly basis.

[7] See *Llei 6/1993, de 15 de juliol*, by the Catalan Parliament.

[INSERT TABLE 2 ABOUT HERE]

Descriptive statistics on firm entries (see Table 2) indicate that there are noticeable differences in the different typology of municipalities depending on their size. Smaller municipalities receive few new firms during the whole period, whilst bigger ones attract a much greater number.

As our data exhibits both a 'zero problem' and an 'overdispersion problem', following Hilbe (2014) we calculated a Pearson-based dispersion statistic and results suggest using NB. Regarding general features of this estimation procedure, NB assumes between-subject heterogeneity and that the process is the same for both zero and non-zero counts. A clear example when analysing firms' location patterns is the spatial/temporal dependence of such decisions, as determinants are strongly time invariant.

Nevertheless, using NB is not the only possible solution to deal with the characteristics of the data set. Since our data for entering firms covers a period of 11 years (from 2004 to 2014), we can examine entry determinants, not only across municipalities, but also over time using a panel specification. Panel regressions have several advantages as these *i)* avoid bias in the parameter estimates characteristic of cross-section analyses, as they can control for the effects of unobserved time-invariant characteristics within geographical units, and *ii)* reduce potential endogeneity between dependent and independent variables.

Although most of the location literature uses cross-section approaches, Poisson panel specifications "naturally allow for large sets of location choices with frequent zero outcomes and control for unobserved municipality heterogeneity" (Holl, 2004a, p. 341). In this sense, fixed-effects strategies have been used by, among others, Holl (2004a, 2004b), Becker and Henderson (2000), List and McHone (2000) and Papke (1991). In her paper on the role of local tax differentials in locations, Papke (1991) controlled unobserved heterogeneity (which is a typical feature in location analysis as there are many alternatives) using a panel Poisson specification. Natural extensions of this specification are the Fixed-Effects NB used by Kim *et al*. (2018) and Holl (2004b). The main advantage of Fixed-Effect NB regressions as opposed to Poisson Fixed-Effects is that the geographical specific heterogeneity term is not contained in the likelihood, which means that time invariant explanatory variables can be used with panel data version of NB (Hausman *et al*., 1984), this not being the case for typical panel data specifications. Additionally, NB estimators for panel data can cope with the equidispersion imposed by the Poisson distribution.[8] Nevertheless, it is not obvious how best to select one specification rather than another. In location analysis, overdispersion in dependent variable may be explained by clusterisation of entries in few areas due to unobserved location-specific heterogeneity, so a Fixed-Effects Poisson should be adequate to handle such overdispersion, although it is also recommended to estimate both (Poisson and NB) versions of Fixed-Effects (Cameron and Trivedi, 1998).

Having solved the issues such as unobserved time-invariant characteristics, equidispersion, etc., one then needs to tackle the spatial issues. Unfortunately, spatial count data models are not yet fully developed[9] and one of the exceptions dealing with space is the Poisson Conditional Fixed-Effects (PCFE), which is able to handle time-invariant spatial dependence as "in comparison with clustering as a standard approach to address cross-sectional dependence, the spatial variance estimator is more general than clustering because it allows for dependence between any pair of individuals while clustering only allows for dependence within groups" (Bertanha and Moser, 2016, p. 50). Therefore, in addition to cross-sectional CD estimation (Poisson and NB, both clustered at county level), we explore alternative settings as panel Poisson (PP), panel NB (PNB) and Poisson Conditional Fixed-Effects (PCFE).

[8] There are other studies using non-CD panel models for the analysis of firms' location decisions, which include Becker *et al*. (2012) and Jeppesen *et al*. (2002).

[9] There are other alternatives for dealing with spatial issues in a panel framework, such as Spatial Error and Spatial Lag Models (Bernardini Papalia and Bertarelli, 2009) and Fixed Effects Spatial Durbin Model (Ho and Berggrem, 2020) but, due to the nature of our dependent variable, count of new firms, they are not considered in this paper.

3. Results and discussion

The distribution of entering firms in terms of their sustainability profile (*i.e.*, the industry to which they belong) shows a steady pattern across the whole period analysed (2004–2014), since LOWMED and HIGH industries alternate their predominance, being followed by MEDHIGH and, a considerable distance behind, LOW industries, as shown in Figure 2.

[INSERT FIGURE 2 ABOUT HERE]

The previous results are quite surprising in view of current context regarding sustainability issues, as it seems reasonable to expect entries to move from more polluting to fewer polluting activities, but it is also true that a 10-year period is not long enough to achieve such structural change. Although sustainability concerns have grown exponentially in recent years, that process only took off after the Paris Agreement on Climate Change in 2015 (United Nations, 2015).

[INSERT FIGURE 3 ABOUT HERE]

The spatial distribution of entries is shown in Figure 3 at industry level. In general terms, new firms agglomerate in and around main metropolitan areas (especially in the region of Barcelona), but also along the highway network.

By way of comparison, we show the results of the three count data specifications explored in previous section (*i.e.*, Poisson; Negative Binomial, -*NegBin*-; and Fixed-Effects Poisson with Robust Standard Errors, -*FE Poisson RSE*-).[10] As we have failed to reject the null hypothesis of time-invariant spatial dependence, there is no need to compute the Poisson Conditional Fixed-Effects (PCFE) specification, so these results are not shown.[11]

[INSERT TABLE 3 ABOUT HERE]

The results of baseline econometric specification clearly differ across industries (see Table 3) in terms of the effects of local sustainability-oriented policies on entries, although the other covariates are quite similar across industries (see De Silva *et al*., 2017, for analogous results regarding Green and non-Green industries). Extended econometric specifications including spatial effects confirm these findings (see Table 4). Although fixed-effects estimations are preferred as they can handle unobserved heterogeneity, here the results for both cross-sectional and fixed-effects estimations are reported.

[INSERT TABLE 4 ABOUT HERE]

As for the specifications without spatial effects, there are clear patterns at industry level that illustrate the role played by local sustainability-oriented policies in terms of location. For the cross-sectional specifications (Poisson and Negative Binomial) the local efforts in waste separate collection (WASTE) have no significant effects on firm entries for the LOW, LOWMED and MEDHIGH industries; HIGH entries are lower in more sustainable oriented municipalities. Nevertheless, when the panel specifications are used, then the effects of WASTE become positive and significant for the LOWMED, MEDHIGH and HIGH industries. These results indicate a clear and direct effect of waste separate collection on entries of firms belonging to more sustainable industries. As waste separate collection increases, firm entries from these industries also increase.

In all the specifications, we have controlled by the number of inhabitants (POP), the income level (INCOME), the unemployment rate (UNE), the self-employed workers in manufacturing activities (SELF_MAN), the ratio between population and jobs (POP_JOBS) and population growth in the previous year (POPC). Local size in terms of population (POP) proxies agglomeration economies and fosters the entry of new firms in all industries (for similar results, see De Silva *et al*., 2017, and List and Co, 2000). Local income (INCOME) has opposite effects depending on the estimation technique (*i.e.*, positive for cross-section and negative for panel), but the panel effects suggest that high-income areas are not targeted by entering firms, presumably because of higher operational costs such as land costs. In any case, this effect

[10] Fixed-Effects Negative Binomial are not shown as they do not converge.
[11] They are available on request from the author.

is similar to the one reported by De Silva *et al*., 2017, although their highly disaggregated analysis makes comparison difficult. When looking at the labour market covariates, Unemployment (UNE) deters entry for all industries and specification methods which is easily explained in terms of availability of labour inputs, but this effect is lower for HIGH industries as these tend to hire a profile of (skilled) workers that are typically less affected by unemployment; and the existence of self-employed workers in manufacturing also pushes up the entry of new firms. Competition for available sites between population and firms is also captured by the ratio between population and jobs (POP_JOBS) and population growth (POPC), as entries are lowered by a relative specialization in residential, rather than in economic, activities and, additionally, by population growth process that require additional dwelling services (although this interpretation is only supported by the panel estimations).

When adding spatial effects, the previous results are confirmed by most of the specifications and spatially lagged variables help us to better understand entry processes. Looking at our variable of primary interest, the results for spatial lag of waste sorting (W_WASTE) are not conclusive as the (low) negative effect is significant mainly for cross-sectional specifications, but not for panel ones. Whilst local income deters entry, income levels in neighbour areas (W_INCOME) foster location of new plants suggesting spatial asymmetries in terms of income. Nevertheless, the spatial scope of the effects of population (W_POP), unemployment (W_UNE) and self-employed in manufacturing (W_SELFMAN) are clearly lower as spatial lagged covariates are of less significance than their counterparts at municipality level.

To sum up, waste collection efforts play a role in terms of location decisions, boosting entries for the LOWMED, MEDHIGH and HIGH industries, which suggests that local social norms on environmental issues which translate into environmental responsible policies, ultimately have an effect in terms of local economic activities. Although these policies may not be considered as entry-promoting, they positively affect the location patterns of more sustainable firms.

4. Robustness check

The robustness of the results obtained in the previous section was tested using alternative covariates and is shown in Tables A.2 (without spatially lagged variables) and A.3 (with spatially lagged variables). Alternative covariates are used for the following control variables: population density[12] rather than total population (POPD vs. POP) and its spatially lagged counterpart (W_POPD); employees (with wage) in manufacturing rather than self-employed workers in manufacturing (WW_MAN vs. SELF_MAN) and its spatially lagged counterpart (W_WMAN); and the ratio of total jobs over population rather than the ratio of population to total jobs (JOBS_POP vs. POP_JOBS). These results roughly mimic previous ones regarding the role played by WASTE and by the other covariates.[13]

In any case, since the results are quite similar across alternative specifications, our empirical strategy consisting of estimating both cross-sectional count data specifications (Poisson and Negative Binomial) and panel count data specifications (Fixed-Effects Poisson and Fixed-Effects Poisson with Robust Standard Errors, as well with Poisson Conditional Fixed-Effects, not shown here but available upon request) provides sufficient evidence for the robustness of the empirical exercise.

5. Conclusions

This paper analyses the spatial distribution of entering firms in Catalan municipalities over the period 2004–2014, focusing on the sustainability dimension of the industries to which these firms belong. We built a sustainability classification based on the proposal by Central Pollution Control Board (CPCB, 2016), and grouped entering firms into four sustainability groups using a NACE 3-digit classification: LOW, LOW-MED, MED-HIGH and HIGH.

Overall, our results show that *i)* there is a clear agglomeration of entries in and around the main metropolitan areas, especially Barcelona; *ii)* although the sustainability profile of entries is quite steady over the period

[12] The analysis by Melo *et al*. (2010) for firm entry on Portuguese municipalities shows a similar (positive) effect of population density.

[13] In all the estimations, we rejected the null hypothesis of time-invariant spatial dependence, which implies that there is no need to compute the Poisson Conditional Fixed-Effects specification.

analysed, the share of firms from less sustainable industries decreases slightly, *iii)* industry specialisation patterns from a spatial point of view are unclear; and *iv)* even if local clusters of entries at industry level are very scarce, there are some geographical regularities that indicate common entry patterns for areas larger than municipalities. These results contribute to the location literature by providing potential tools for city councils to attract sustainability-oriented firms in order to boost transition to a more sustainable economy. This is an important finding as most of the literature on environmental policies and firm location analyse national and regional regulations, but not local ones.

In terms of the hypotheses of the paper, all of them are confirmed by the econometric results. Concretely, as the spatial distribution of entrants is very asymmetric, we have demonstrated that territories differ in their capacity to attract new firms (H. 1); as the spatial distribution of entrants of different industries also differs, industries differ in their locational preferences (H. 2); and as sustainable practices in waste collection increases entries for all industries except for the ones with a low sustainability profile, territories concerned about environmental issues are better positioned to attract firms from sustainable industries (H. 3). These are important findings because matching a firm's activities with local social norms may indicate relevant courses of action (Meek *et al*., 2010).

There are some policy implications from the previous results, as they show that structural changes towards more sustainable activities are very slow, only partially clustered, and do require specific policy actions in order to boost the process, which suggests that additional public efforts should be implemented in order to reorient the industry composition of new entrants towards a stronger sustainable profile. Nevertheless, as these entrants are affected by the prevalent socio-environmental norms of an area, understanding these norms may play a role when designing entry-promoting measures. Finally, this paper has two potential limitations. The first one is in regard to the *ad-hoc* classification for sustainability that we use. Here, we acknowledge a potential bias in our results due to the allocation of 3-digit industries to a particular group. Future research will try to solve this issue by exploring alternative groupings in terms of the sustainability profiles of entering firms. The second one refers to the specific institutional setting covered by this analysis (i.e., municipalities at the EU level), since results may not fully generalise to other areas such as developing economies—this highlights the necessity of extending similar analyses to other countries.

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Tables

Table 1. Explanatory variables: definition, sources and descriptive statistics

Variable	Definition	Source
WASTE	Waste separate collection (%)	Own elaboration from Waste Agency of Catalonia data.
POP	Number of inhabitants	IDESCAT
INCOME	General taxable income per declaring party (euros)	IDESCAT
UNE	Unemployment rate (%)	Own elaboration from IDESCAT.
SELF_MAN	Self-employment in manufacturing	IDESCAT
POP_JOBS	Ratio Population / Jobs	Own elaboration from IDESCAT
POPC	Population change (t-1 related to t-2 in %)	Own elaboration from IDESCAT.

Whole sample

Variable	Mean	Std. dev.	Min	Max
WASTE	28.924	17.133	0	100
POP	7675.830	55451.710	0	1,621,537
INCOME	16202.240	4677.946	0	50,856
UNE	5.968	3.805	0	22.712
SELF_MAN	55.238	317.822	0	11,215
POP_JOBS	4.298	3.158	0	94
POPC	1.494	4.271	-100	82.191

Municipalities with at least one entry

Variable	Mean	Std. dev.	Min	Max
WASTE	29.330	16.852	0.011	100
POP	23158.720	104670.700	80	1,621,537
INCOME	17483.290	4603.491	6237	41998
UNE	6.514	3.619	0	22.712
SELF_MAN	159.500	595.658	0	11,215
POP_JOBS	3.284	1.469	0.204	18.819
POPC	2.023	2.996	-9.389	20.290

Table 2. Descriptive statistics about firm entries (all industries) and WASTE

Firm entries						
Typology of municipalities (inhabitants)	N	Mean	Standard deviation	Min	Max	% of zeroes
Up to 10,000	844	3.905	6.516	0	49	34.24
10,000 to 50,000	79	48.240	31.294	0	152	1.27
50,000 to 100,000	14	165.071	103.140	71	449	0.00
100,000 to 500,000	8	320.125	174.727	107	564	0.00
More than 500,000	1	2507.500	3543.312	2	5013	0.00
Waste						
Typology of municipalities (inhabitants)	N	Mean	Standard deviation	Min	Max	
Up to 10,000	844	28.410	17.327	0	100.00	
10,000 to 50,000	79	33.006	15.495	2.15	100.00	
50,000 to 100,000	14	31.185	11.443	11.49	77.02	
100,000 to 500,000	8	31.717	17.009	8.57	91.26	
More than 500,000	1	28.219	6.689	17.47	37.28	

Table 3. Determinants of entries: baseline specification[a]

	LOW			LOWMED			MEDHIGH			HIGH		
Variables	**P**	**NegBin**	**P FE RSE**	**P**	**NegBin**	**P FE RSE**	**P**	**NegBin**	**P FE RSE**	**P**	**NegBin**	**P FE RSE**
WASTE	-0.00324	-0.00267	0.00126	-0.00470	-0.00401	0.00521**	-0.00484	-0.00444	0.00849***	-0.00781*	-0.00800**	0.00726**
	0.00284	0.00249	0.00276	0.00333	0.00271	0.00221	0.00362	0.00312	0.00277	0.00456	0.00314	0.00318
POP	-8.25e-07	1.73e-06	6.39e-05***	1.66e-07	1.62e-05	4.20e-05***	4.74e-07	2.03e-05	3.54e-05***	7.65e-07**	2.63e-05	4.07e-05***
	1.08e-06	1.14e-05	1.92e-05	7.20e-07	1.51e-05	1.28e-05	3.84e-07	1.72e-05	9.44e-06	3.84e-07	2.00e-05	8.29e-06
INCOME	2.15e-05*	7.45e-06	-0.000243***	2.62e-05*	2.77e-06	-0.000278***	4.41e-05***	3.16e-05*	-0.000297***	6.29e-05***	3.25e-05*	-0.000333***
	1.29e-05	1.50e-05	2.51e-05	1.56e-05	1.58e-05	2.16e-05	1.46e-05	1.72e-05	2.40e-05	2.05e-05	1.88e-05	3.63e-05
UNE	0.0593***	0.0528***	0.0575***	0.0560***	0.0523***	0.0535***	0.0754***	0.0736***	0.0498***	0.0427***	0.0252	0.0180
	0.0118	0.0141	0.0160	0.0102	0.0152	0.0120	0.0146	0.0213	0.0142	0.0163	0.0209	0.0134
SELF_MAN	0.000609***	0.00313***	0.000787***	0.000469***	0.00276***	0.000462***	0.000449***	0.00261**	0.000379***	0.000435***	0.00270**	0.000372***
	0.000171	0.000982	0.000152	0.000113	0.000899	9.00e-05	5.80e-05	0.00115	6.83e-05	5.07e-05	0.00123	5.99e-05
POP_JOBS	-0.438***	-0.419***	-0.263*	-0.362***	-0.294***	-0.274***	-0.362***	-0.292***	0.00713	-0.419***	-0.279***	-0.170
	0.0554	0.0604	0.155	0.0533	0.0417	0.0872	0.0577	0.0457	0.123	0.0704	0.0480	0.147
POPC	0.0301***	0.0516***	-0.0122	0.0281***	0.0531***	-0.0374**	0.0288***	0.0618***	-0.0479**	0.0256**	0.0643***	-0.0811**
	0.00907	0.0122	0.0266	0.00890	0.0132	0.0165	0.00988	0.0137	0.0242	0.0115	0.0137	0.0411
lnalpha		1.305***			1.142***			1.440***			1.545***	
		0.226			0.205			0.246			0.231	
Constant	-1.385***	-1.678***		-0.334	-0.879***		-1.490***	-2.326***		-0.972**	-1.796***	
	0.327	0.335		0.320	0.258		0.356	0.298		0.445	0.294	
Obs.	10,375	10,375	3,515	10,375	10,375	6,207	10,375	10,375	3,823	10,375	10,375	4,352
N. of codes			320			565			348			396

Notes: [a] The dependent variable is the number of entries. Econometric specifications are the following: Poisson (P), Negative Binomial (NegBin), and Fixed-Effects Poisson with Robust Standard Errors (P FE RSE).
*** Significance at 1%, ** significance at 5% and * significance at 10%.

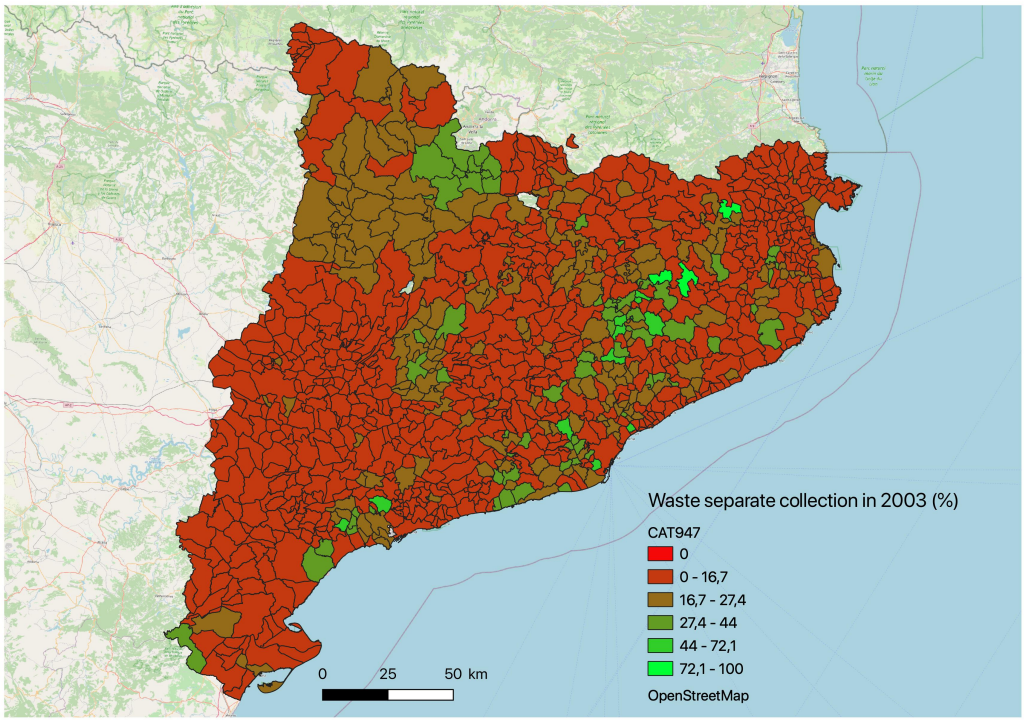
Table 4. Determinants of entries: extended specification with spatial effects [b]

	LOW			LOWMED			MEDHIGH			HIGH		
Variables	**P**	**NegBin**	**P FE RSE**	**P**	**NegBin**	**P FE RSE**	**P**	**NegBin**	**P FE RSE**	**P**	**NegBin**	**P FE RSE**
WASTE	-0.00322	-0.00278	0.00138	-0.00453	-0.00391	0.00553**	-0.00485	-0.00409	0.00864***	-0.00758	-0.00739**	0.00788**
	0.00292	0.00246	0.00280	0.00342	0.00262	0.00220	0.00373	0.00313	0.00277	0.00474	0.00291	0.00315
W_WASTE	-0.0218***	-0.0128**	-0.00193	-0.0139**	-0.000373	-0.00322	-0.0127	0.00520	0.00177	-0.0176**	0.00237	-0.00611
	0.00745	0.00624	0.00548	0.00601	0.00403	0.00331	0.00861	0.00476	0.00480	0.00770	0.00582	0.00439
POP	-1.03e-06	2.68e-06	6.31e-05***	5.94e-08	1.65e-05	3.95e-05***	4.01e-07	2.11e-05	3.33e-05***	6.04e-07	2.76e-05	4.18e-05***
	1.17e-06	1.26e-05	1.81e-05	7.89e-07	1.52e-05	1.20e-05	4.42e-07	1.66e-05	9.78e-06	4.36e-07	1.95e-05	8.43e-06
W_POP	-2.05e-05	-2.60e-05***	-1.00e-05	-7.73e-06	4.78e-06	3.24e-06	-1.75e-05**	-7.34e-06	-6.14e-06	-8.07e-06	-1.04e-06	-8.06e-06*
	1.34e-05	9.40e-06	9.25e-06	6.92e-06	5.74e-06	4.88e-06	7.90e-06	8.71e-06	6.79e-06	5.98e-06	6.96e-06	4.70e-06
INCOME	9.70e-06	4.27e-07	-0.00024***	2.03e-05	1.98e-06	-0.00027***	3.83e-05**	2.81e-05	-0.00029***	5.56e-05**	2.73e-05	-0.00034***
	1.71e-05	1.57e-05	2.55e-05	1.91e-05	1.61e-05	2.13e-05	1.87e-05	1.79e-05	2.48e-05	2.37e-05	1.91e-05	3.92e-05
W_INCOME	5.21e-05**	1.26e-05	4.01e-05	5.16e-05**	1.25e-05	4.20e-05**	3.99e-05*	-4.20e-06	4.11e-05*	7.79e-05**	7.54e-06	6.07e-05*
	2.14e-05	1.53e-05	2.55e-05	2.25e-05	1.56e-05	2.03e-05	2.42e-05	1.62e-05	2.33e-05	3.05e-05	1.43e-05	3.55e-05
UNE	0.0602***	0.0530***	0.0571***	0.0569***	0.0527***	0.0537***	0.0755***	0.0718***	0.0496***	0.0431***	0.0234	0.0238
	0.0123	0.0148	0.0159	0.0104	0.0150	0.0117	0.0147	0.0204	0.0139	0.0165	0.0199	0.0146
W_UNE	-0.0102	0.00569	0.000909	-0.0100	-0.0126	0.0140	-0.00556	-0.0340	0.0607	-0.0238	-0.0449	0.00643
	0.0476	0.0375	0.0506	0.0420	0.0271	0.0344	0.0483	0.0365	0.0564	0.0586	0.0381	0.0618
SELF_MAN	0.000619***	0.00286***	0.000802***	0.000477***	0.00273***	0.000456***	0.000450***	0.00242**	0.000382***	0.000450***	0.00239*	0.000414***
	0.000183	0.00104	0.000152	0.000124	0.000987	8.89e-05	7.01e-05	0.00119	7.47e-05	6.11e-05	0.00127	6.40e-05
W_SELFMAN	0.00305	0.00391***	0.00120	0.000887	-0.000792	-0.000759	0.00222**	0.00128	0.000532	0.000852	0.000498	0.00118*
	0.00201	0.00130	0.00141	0.00107	0.000886	0.000759	0.00110	0.00143	0.000981	0.000857	0.00116	0.000637
POP_JOBS	-0.429***	-0.415***	-0.246*	-0.356***	-0.292***	-0.255***	-0.357***	-0.288***	0.0323	-0.409***	-0.270***	-0.117
	0.0586	0.0621	0.142	0.0559	0.0413	0.0774	0.0621	0.0463	0.109	0.0735	0.0481	0.106
POPC	0.0325***	0.0510***	-0.0109	0.0298***	0.0533***	-0.0348**	0.0302***	0.0614***	-0.0462**	0.0304***	0.0640***	-0.0668**
	0.00864	0.0122	0.0243	0.00879	0.0131	0.0141	0.00996	0.0135	0.0202	0.0105	0.0132	0.0264
lnalpha		1.283***			1.142***			1.432***			1.534***	
		0.228			0.205			0.253			0.236	
Constant	-1.446***	-1.477**		-0.662	-0.991**		-1.676***	-2.182***		-1.548**	-1.696***	
	0.552	0.595		0.556	0.483		0.583	0.544		0.635	0.542	
Obs.	10,375	10,375	3,515	10,375	10,375	6,207	10,375	10,375	3,823	10,375	10,375	4,352
No. of codes			320			565			348			396

Notes: [b] The dependent variable is the number of entries. Econometric specifications are the following: Poisson (P), Negative Binomial (NegBin), and Fixed-Effects Poisson with Robust Standard Errors (P FE RSE).
*** Significance at 1%, ** significance at 5% and * significance at 10%.

Figures

Figure 1. Waste separate collection in 2003 and 2013 (%)



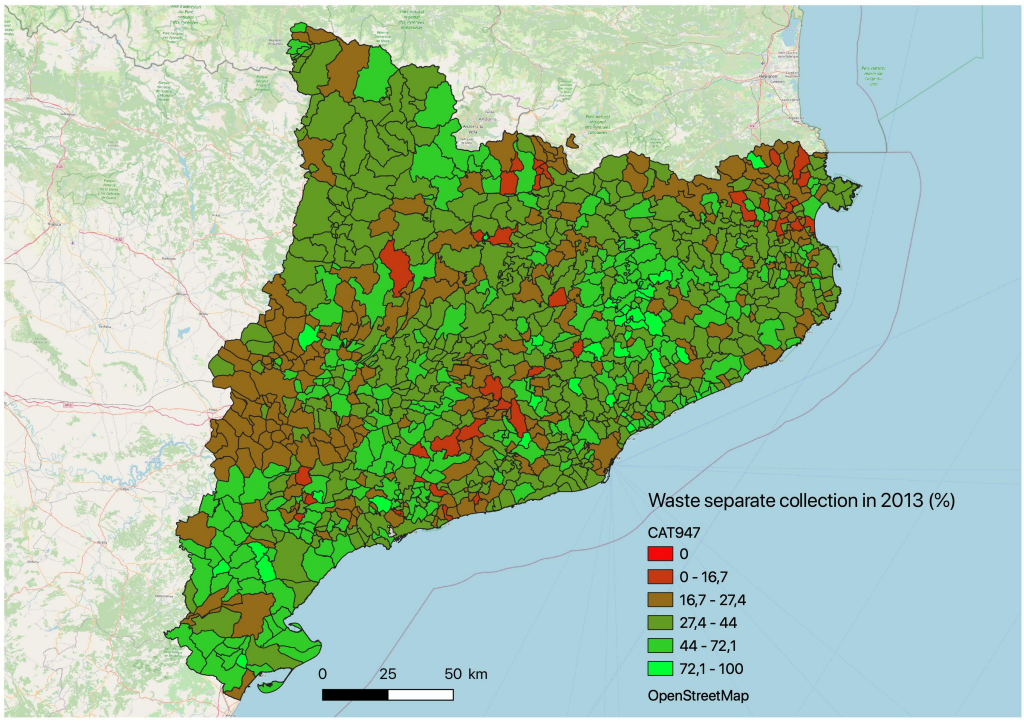


Figure 2. Entries at industry level

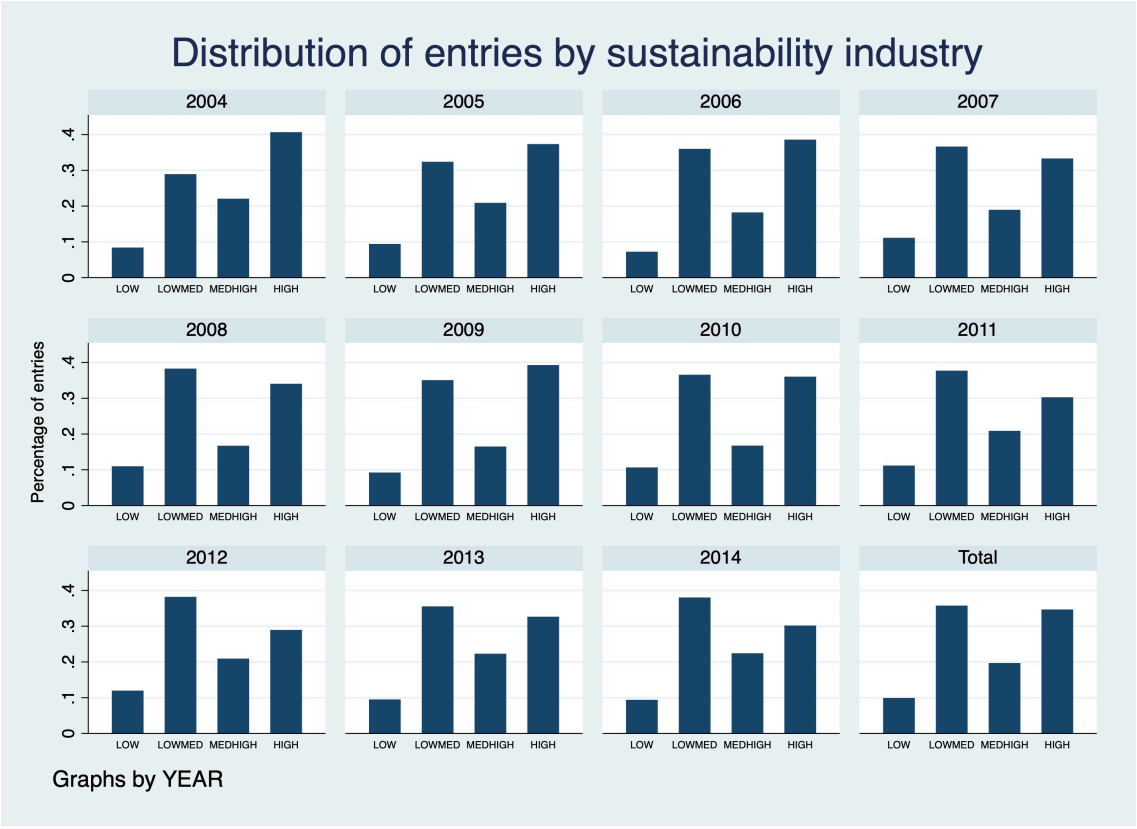
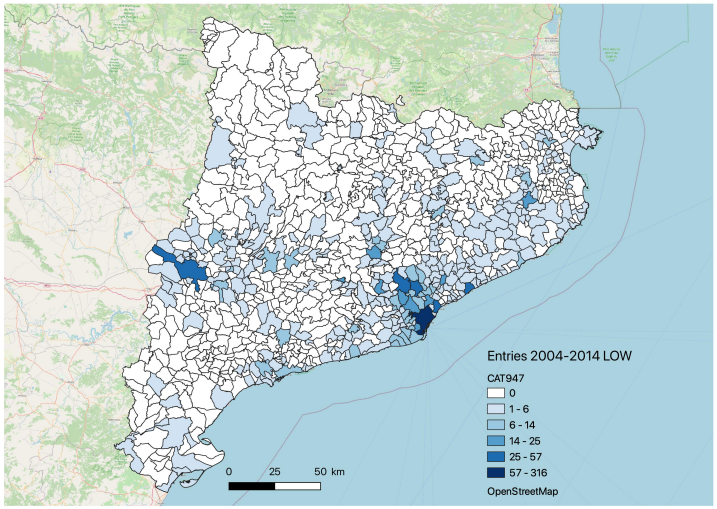
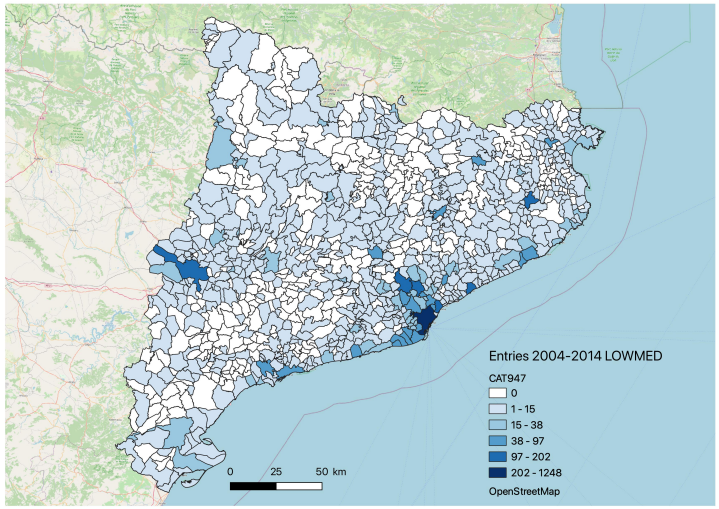
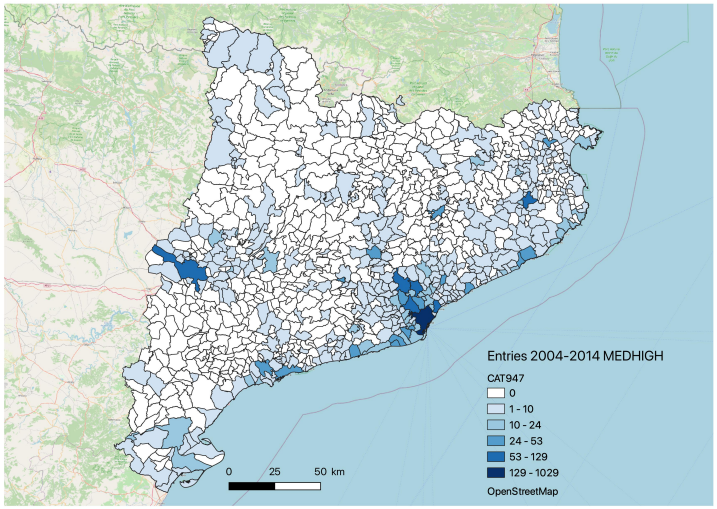
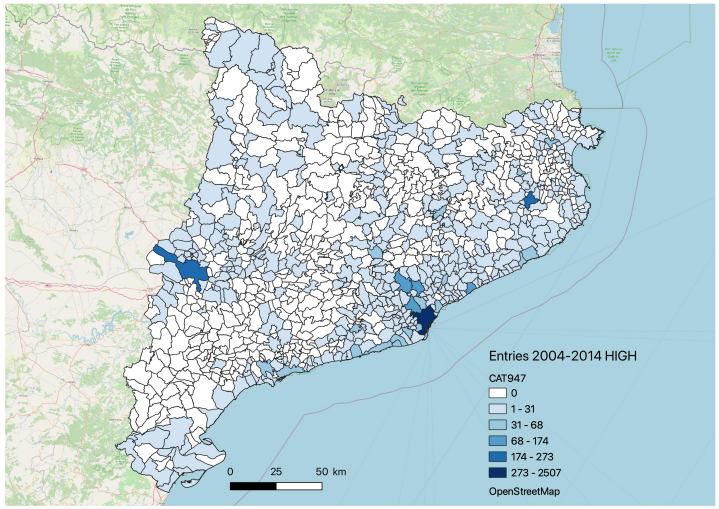


Figure 3. Total entries









Appendix

Table A.1: Classification of industries (3-digit) in terms of sustainability

LOW	
Code	**Name**
51	Mining of hard coal
52	Mining of lignite
61	Extraction of crude petroleum
62	Extraction of natural gas
71	Mining of iron ores
72	Mining of non-ferrous metal ores
81	Quarrying of stone, sand and clay
89	Mining and quarrying n.e.c.
120	Preparation and spinning of textile fibres
131	Weaving of textiles
132	Finishing of textiles
133	Manufacture of knitted and crocheted fabrics
139	Manufacture of carpets and rugs
141	Manufacture of other outerwear
142	Manufacture of knitted and crocheted hosiery
171	Manufacture of articles of paper and paperboard
172	Manufacture of paper stationery
191	Manufacture of refined petroleum products
192	Manufacture of basic chemicals, fertilisers and nitrogen compounds, plastics and synthetic rubber in primary forms
201	Manufacture of other inorganic basic chemicals
202	Manufacture of paints, varnishes and similar coatings, printing ink and mastics
204	Manufacture of other chemical products
206	Manufacture of basic pharmaceutical products
211	Manufacture of pharmaceutical preparations
235	Manufacture of articles of concrete, cement and plaster
237	Production of abrasive products
239	Manufacture of basic metals
241	Manufacture of tubes, pipes, hollow profiles and related fittings, of steel
242	Cold drawing of bars
243	Cold forming or folding
244	Lead, zinc and tin production
245	Casting of light metals
251	Manufacture of tanks, reservoirs and containers of metal
252	Manufacture of steam generators, except central heating hot water boilers
253	Manufacture of weapons and ammunition
254	Forging, pressing, stamping and roll-forming of metal; powder metallurgy
255	Treatment and coating of metals
256	Manufacture of cutlery, tools and general hardware
257	Manufacture of tools
259	Manufacture of wire products, chain and springs
261	Manufacture of computers and peripheral equipment
262	Manufacture of communication equipment
268	Manufacture of electric motors, generators, transformers and electricity distribution and control apparatus
271	Manufacture of batteries and accumulators
272	Manufacture of fibre optic cables
274	Manufacture of electric domestic appliances
275	Manufacture of other electrical equipment
279	Manufacture of general-purpose machinery
281	Manufacture of other pumps and compressors
282	Manufacture of office machinery and equipment (except computers and peripheral equipment)
283	Manufacture of metal forming machinery
284	Manufacture of other special-purpose machinery
289	Manufacture of machinery for food, beverage and tobacco processing
291	Manufacture of bodies (coachwork) for motor vehicles; manufacture of trailers and semi-trailers
292	Manufacture of electrical and electronic equipment for motor vehicles
293	Manufacture of other transport equipment
301	Manufacture of railway locomotives and rolling stock
302	Manufacture of air and spacecraft and related machinery
303	Manufacture of military fighting vehicles
304	Manufacture of motorcycles

309	Manufacture of other transport equipment n.e.c.
321	Manufacture of imitation jewellery and related articles
322	Manufacture of sports goods
323	Manufacture of games and toys
325	Manufacture of brooms and brushes
332	Electricity, gas, steam and air conditioning supply
351	Distribution of electricity
352	Water collection, treatment and supply
353	Sewerage
381	Dismantling of wrecks
491	Freight transport by road and removal services
492	Removal services
494	Sea and coastal freight water transport
495	Inland passenger water transport
501	Air transport
502	Passenger air transport
503	Freight air transport
504	Warehousing and support activities for transportation
510	Mining of hard coal
511	Support activities for transportation
512	Service activities incidental to water transportation
520	Mining of lignite
610	Extraction of crude petroleum
710	Mining of iron ores
729	Mining of other non-ferrous metal ores
741	Veterinary activities
891	Mining of chemical and fertiliser minerals
892	Extraction of peat
893	Extraction of salt
LOWMED	
Code	**Name**
11	Growing of non-perennial crops
12	Growing of perennial crops
13	Plant propagation
14	Animal production
15	Mixed farming
16	Support activities to agriculture and post-harvest crop activities
17	Hunting, trapping and related service activities
21	Silviculture and other forestry activities
22	Logging
23	Gathering of wild growing non-wood products
24	Support services to forestry
31	Fishing
32	Aquaculture
91	Support activities for petroleum and natural gas extraction
99	Support activities for other mining and quarrying
101	Processing and preserving of meat and production of meat products
102	Processing and preserving of fish, crustaceans and molluscs
103	Processing and preserving of potatoes
104	Manufacture of oils and fats
105	Manufacture of ice cream
106	Manufacture of bakery and farinaceous products
107	Manufacture of macaroni, noodles, couscous and similar farinaceous products
108	Processing of tea and coffee
109	Manufacture of beverages
110	Manufacture of cider and other fruit wines
111	Growing of cereals (except rice), leguminous crops and oil seeds
112	Growing of rice
113	Growing of vegetables and melons, roots and tubers
114	Growing of sugar cane
115	Growing of tobacco
116	Growing of fibre crops
119	Growing of other non-perennial crops
121	Growing of grapes
122	Growing of tropical and subtropical fruits
123	Growing of citrus fruits
124	Growing of pome fruits and stone fruits

125	Growing of other tree and bush fruits and nuts
126	Growing of oleaginous fruits
127	Growing of beverage crops
128	Growing of spices, aromatic, drug and pharmaceutical crops
129	Growing of other perennial crops
130	Plant propagation
161	Manufacture of veneer sheets and wood-based panels
162	Manufacture of other builders' carpentry and joinery
182	Manufacture of coke oven products
203	Manufacture of soap and detergents, cleaning and polishing preparations
205	Manufacture of essential oils
212	Manufacture of rubber products
221	Manufacture of plastics products
222	Manufacture of builders' ware of plastic
232	Manufacture of ceramic tiles and flags
233	Manufacture of other porcelain and ceramic products
234	Manufacture of ceramic insulators and insulating fittings
273	Manufacture of wiring devices
310	Manufacture of mattresses
311	Marine fishing
312	Freshwater fishing
329	Repair and installation of machinery and equipment
360	Collection of non-hazardous waste
370	Treatment and disposal of non-hazardous waste
382	Remediation activities and other waste management services
383	Construction of buildings
390	Construction of residential and non-residential buildings
411	Construction of railways and underground railways
412	Construction of utility projects
421	Construction of water projects
422	Demolition
429	Electrical, plumbing and other construction installation activities
431	Building completion and finishing
432	Painting and glazing
433	Other specialised construction activities n.e.c.
439	Maintenance and repair of motor vehicles
451	Sale, maintenance and repair of motorcycles and related parts and accessories
452	Wholesale on a fee or contract basis
462	Wholesale of dairy products, eggs and edible oils and fats
463	Wholesale of other food, including fish, crustaceans and molluscs
464	Wholesale of watches and jewellery
465	Wholesale of office furniture
466	Other specialised wholesale
467	Non-specialised wholesale trade
551	Food and beverage service activities
552	Restaurants and mobile food service activities
553	Event catering activities
559	Beverage serving activities
799	Combined facilities support activities
801	General cleaning of buildings
802	Other cleaning activities
803	Landscape service activities
899	Other mining and quarrying n.e.c.
900	Gambling and betting activities
932	Repair of computers and personal and household goods
941	Repair of consumer electronics
942	Repair of furniture and home furnishings
949	Repair of other personal and household goods
MEDHIGH	
Code	**Name**
143	Manufacture of leather and related products
151	Manufacture of footwear
152	Sawmilling and planing of wood
181	Pre-press and pre-media services
210	Silviculture and other forestry activities
220	Logging
230	Gathering of wild growing non-wood products

236	Manufacture of ready-mixed concrete
240	Support services to forestry
453	Agents involved in the sale of fuels, ores, metals and industrial chemicals
454	Agents involved in the sale of furniture, household goods, hardware and ironmongery
461	Agents specialised in the sale of other particular products
469	Retail sale of meat and meat products in specialised stores
471	Retail sale of beverages in specialised stores
472	Retail sale of automotive fuel in specialised stores
473	Retail sale of hardware, paints and glass in specialised stores
474	Retail sale of electrical household appliances in specialised stores
475	Retail sale of newspapers and stationery in specialised stores
476	Retail sale of footwear and leather goods in specialised stores
477	Other retail sale of new goods in specialised stores
478	Land transport and transport via pipelines
479	Freight rail transport
855	Medical and dental practice activities
856	Other human health activities
951	Funeral and related activities
952	producing activities of households for own use
960	Undifferentiated service-producing activities of private households for own use
493	Transport via pipeline
521	Postal and courier activities
522	Postal activities under universal service obligation
531	Holiday and other short-stay accommodation
532	Camping grounds, recreational vehicle parks and trailer parks
HIGH	
Code	**Name**
231	Manufacture of hollow glass
263	Manufacture of consumer electronics
264	Manufacture of instruments and appliances for measuring, testing and navigation
265	Manufacture of irradiation, electromedical and electrotherapeutic equipment
266	Manufacture of optical instruments and photographic equipment
267	Manufacture of magnetic and optical media
324	Manufacture of medical and dental instruments and supplies
331	Repair of electronic and optical equipment
561	Publishing activities
562	Book publishing
563	Publishing of journals and periodicals
581	Other software publishing
582	Motion picture projection activities
591	Radio broadcasting
592	Wireless telecommunications activities
601	Satellite telecommunications activities
602	Other telecommunications activities
611	Computer programming activities
612	Computer facilities management activities
613	Information service activities
619	Data processing, hosting and related activities
620	News agency activities
631	Other monetary intermediation
639	Trusts, funds and similar financial entities
641	Other financial service activities, except insurance and pension funding n.e.c.
642	Life insurance
643	Reinsurance
649	Pension funding
651	Security and commodity contracts brokerage
652	Risk and damage evaluation
653	Other activities auxiliary to insurance and pension funding
661	Real estate activities
662	Renting and operating of own or leased real estate
663	Management of real estate on a fee or contract basis
681	Legal activities
682	Accounting, bookkeeping and auditing activities; tax consultancy
683	Activities of head offices
691	Architectural and engineering activities; technical testing and analysis
692	Architectural activities
701	Technical testing and analysis

702	Research and experimental development on natural sciences and engineering
711	Research and experimental development on social sciences and humanities
712	Advertising agencies
721	Market research and public opinion polling
722	Specialised design activities
731	Translation and interpretation activities
732	Other professional, scientific and technical activities n.e.c.
742	Rental and leasing activities
743	Renting and leasing of cars and light motor vehicles
749	Renting and leasing of personal and household goods
750	Renting and leasing of other personal and household goods
771	Renting and leasing of office machinery and equipment (including computers)
772	Renting and leasing of other machinery, equipment and tangible goods n.e.c.
773	Activities of employment placement agencies
774	Travel agency and tour operator activities
781	Other reservation service and related activities
782	Security and investigation activities
783	Private security activities
791	Investigation activities
811	Combined office administrative service activities
812	Activities of call centres
813	Business support service activities n.e.c.
821	Other business support service activities n.e.c.
822	Administration of the State and the economic and social policy of the community
823	Regulation of the activities of providing health care, education, cultural services and other social services, excluding social security
829	Provision of services to the community as a whole
841	Compulsory social security activities
842	Pre-primary education
843	Technical and vocational secondary education
851	Other education
852	Cultural education
853	Other education n.e.c.
854	Human health and social work activities
861	Residential care activities for mental retardation, mental health and substance abuse
862	Residential care activities for the elderly and disabled
869	Social work activities without accommodation
871	Other social work activities without accommodation
872	Other social work activities without accommodation n.e.c.
873	Creative, arts and entertainment activities
879	Support activities to performing arts
881	Libraries, archives, museums and other cultural activities
889	Museums activities
910	Other sports activities
920	Activities of business and employers membership organisations
931	Activities of trade unions

Source: Prepared by the author based on CPCB (2016).

Table A.2. Determinants of entries: baseline specification [c]

	LOW			LOWMED			MEDHIGH			HIGH		
Variables	**P**	**NegBin**	**P FE RSE**	**P**	**NegBin**	**P FE RSE**	**P**	**NegBin**	**P FE RSE**	**P**	**NegBin**	**P FE RSE**
WASTE	-0.00226	-0.00342	0.000247	-0.00405	-0.00551	0.00463**	-0.00402	-0.00656*	0.00844***	-0.00741*	-0.0105**	0.00630**
	0.00288	0.00290	0.00290	0.00338	0.00337	0.00233	0.00352	0.00368	0.00254	0.00447	0.00407	0.00283
POPD	0.000164***	0.000146***	0.000855	0.000165***	0.000226***	0.000255	0.000169***	0.000281***	0.000452	0.000169***	0.000336**	0.00127**
	1.94e-05	4.16e-05	0.000676	1.88e-05	6.92e-05	0.000491	2.38e-05	8.36e-05	0.000426	2.48e-05	0.000144	0.000586
INCOME	3.02e-05*	2.29e-05	-0.000201***	3.61e-05**	2.07e-05	-0.000232***	5.14e-05***	4.84e-05***	-0.000257***	7.22e-05***	4.95e-05***	-0.000298***
	1.58e-05	1.48e-05	2.31e-05	1.74e-05	1.66e-05	1.75e-05	1.65e-05	1.75e-05	1.73e-05	2.14e-05	1.90e-05	2.85e-05
UNE	0.0243**	0.0364**	0.0382**	0.0259**	0.0468***	0.0410***	0.0437***	0.0662***	0.0443***	0.00835	0.0243	0.00934
	0.0108	0.0145	0.0158	0.0120	0.0154	0.0118	0.0157	0.0214	0.0125	0.0176	0.0207	0.0150
WW_MAN	2.59e-05***	0.000395**	3.36e-05***	2.63e-05***	0.000432***	1.69e-05***	2.88e-05***	0.000425**	1.66e-05***	3.28e-05***	0.000516***	1.55e-05***
	2.25e-06	0.000175	4.53e-06	2.33e-06	0.000160	2.62e-06	3.47e-06	0.000182	2.75e-06	3.70e-06	0.000191	3.92e-06
JOBS_POP	0.869***	0.975**	0.268	0.791***	0.746**	0.914	0.784***	0.681*	0.226	0.807***	0.595	1.509
	0.161	0.418	0.967	0.145	0.347	0.668	0.151	0.353	0.772	0.146	0.421	1.590
POPC	0.0356***	0.0506***	0.00268	0.0328***	0.0561***	-0.0251**	0.0340***	0.0633***	-0.0443***	0.0315***	0.0692***	-0.0633**
	0.00613	0.0109	0.0201	0.00679	0.0143	0.0115	0.00726	0.0142	0.0163	0.00812	0.0157	0.0249
lnalpha		1.462***			1.277***			1.544***			1.733***	
		0.292			0.188			0.252			0.210	
Constant	-3.282***	-3.754***		-2.013***	-2.462***		-3.125***	-3.821***		-2.789***	-3.249***	
	0.296	0.275		0.308	0.291		0.321	0.318		0.348	0.349	
Obs.	10,382	10,382	3,515	10,382	10,382	6,207	10,382	10,382	3,823	10,382	10,382	4,352
No. of codes			320			565			348			396

Notes: [c] The dependent variable is the number of entries. Econometric specifications are the following: Poisson (P), Negative Binomial (NegBin), and Fixed-Effects Poisson with Robust Standard Errors (P FE RSE).
*** Significance at 1%, ** significance at 5% and * significance at 10%.

Table A.3. Determinants of entries: extended specification with spatial effects [d]

	LOW			LOWMED			MEDHIGH			HIGH		
Variables	**P**	**NegBin**	**P FE RSE**	**P**	**NegBin**	**P FE RSE**	**P**	**NegBin**	**P FE RSE**	**P**	**NegBin**	**P FE RSE**
WASTE	-0.00212	-0.00326	0.000361	-0.00403	-0.00548*	0.00489**	-0.00417	-0.00633*	0.00831***	-0.00744	-0.0101***	0.00642**
	0.00301	0.00293	0.00294	0.00352	0.00330	0.00238	0.00364	0.00365	0.00251	0.00455	0.00385	0.00270
W_WASTE	-0.0164**	-0.0102	0.000406	-0.00900	0.00203	-0.00322	-0.00716	0.00788	0.00296	-0.0150	0.00606	-0.00566
	0.00716	0.00641	0.00562	0.00552	0.00480	0.00338	0.00847	0.00575	0.00492	0.00925	0.00644	0.00591
POPD	0.000156***	0.000143***	0.000638	0.000164***	0.000229***	0.000146	0.000168***	0.000284***	0.000292	0.000166***	0.000330**	0.00104***
	2.13e-05	3.93e-05	0.000436	2.17e-05	6.48e-05	0.000344	2.70e-05	7.79e-05	0.000256	2.88e-05	0.000139	0.000356
W_POPD	0.000407**	1.93e-05	0.000448***	0.000231	-0.000115	0.000299***	0.000241*	-8.66e-05	0.000293***	0.000212	-0.000222***	0.000329***
	0.000176	0.000108	0.000153	0.000147	7.46e-05	9.40e-05	0.000125	9.68e-05	7.59e-05	0.000154	6.71e-05	8.76e-05
INCOME	1.78e-05	1.79e-05	-0.000203***	3.04e-05	2.22e-05	-0.000235***	4.70e-05**	5.04e-05***	-0.000259***	6.39e-05***	4.79e-05**	-0.000304***
	2.02e-05	1.46e-05	2.36e-05	2.05e-05	1.69e-05	1.77e-05	1.97e-05	1.87e-05	1.75e-05	2.47e-05	1.99e-05	2.79e-05
W_INCOME	3.20e-05	4.60e-05**	6.26e-06	4.36e-05*	4.13e-05**	1.92e-05	3.00e-05	3.11e-05	1.29e-05	6.70e-05**	4.65e-05**	2.67e-05
	2.03e-05	1.81e-05	1.54e-05	2.31e-05	2.10e-05	1.41e-05	2.34e-05	2.00e-05	1.51e-05	3.31e-05	1.99e-05	1.89e-05
UNE	0.0248**	0.0380**	0.0383**	0.0264**	0.0469***	0.0415***	0.0439***	0.0651***	0.0439***	0.00702	0.0244	0.0125
	0.0110	0.0154	0.0150	0.0122	0.0151	0.0112	0.0157	0.0208	0.0121	0.0172	0.0201	0.0141
W_UNE	-0.0461	-0.0176	-0.0402	-0.0331	-0.0188	-0.0191	-0.0285	-0.0314	0.0250	-0.0441	-0.0472	-0.0377
	0.0491	0.0348	0.0474	0.0435	0.0286	0.0263	0.0498	0.0384	0.0409	0.0632	0.0391	0.0307
WW_MAN	2.46e-05***	0.000391**	3.11e-05***	2.55e-05***	0.000433***	1.54e-05***	2.80e-05***	0.000428**	1.53e-05***	3.16e-05***	0.000517***	1.56e-05***
	1.77e-06	0.000175	4.06e-06	2.19e-06	0.000159	2.07e-06	3.10e-06	0.000180	2.18e-06	3.28e-06	0.000188	2.66e-06
W_WMAN	-0.000252***	-4.65e-05	-0.000270***	-0.000171**	3.90e-05	-0.000184***	-0.000169***	1.41e-05	-0.000184***	-0.000144**	0.000137**	-0.000164***
	9.34e-05	5.87e-05	7.82e-05	6.78e-05	4.19e-05	5.74e-05	5.52e-05	6.53e-05	4.36e-05	6.41e-05	5.36e-05	4.92e-05
JOBS_POP	0.860***	0.941**	0.0972	0.768***	0.707**	0.831	0.767***	0.656*	0.0392	0.769***	0.493	1.007
	0.153	0.425	0.835	0.142	0.345	0.554	0.151	0.357	0.659	0.145	0.409	0.851
POPC	0.0356***	0.0510***	0.00146	0.0332***	0.0577***	-0.0268**	0.0339***	0.0647***	-0.0490***	0.0335***	0.0712***	-0.0602***
	0.00621	0.0108	0.0206	0.00692	0.0144	0.0127	0.00750	0.0139	0.0169	0.00787	0.0147	0.0207
lnalpha		1.447***			1.266***			1.534***			1.715***	
		0.295			0.190			0.252			0.212	
Constant	-2.940***	-4.013***		-2.198***	-3.075***		-3.185***	-4.372***		-3.080***	-3.840***	
	0.682	0.565		0.664	0.512		0.705	0.613		0.732	0.612	
Obs.	10,382	10,382	3,515	10,382	10,382	6,207	10,382	10,382	3,823	10,382	10,382	4,352
No. of codes			320			565			348			396

Notes: [d] The dependent variable is the number of entries. Econometric specifications are the following: Poisson (P), Negative Binomial (NegBin), and Fixed-Effects Poisson with Robust Standard Errors (P FE RSE).
*** Significance at 1%, ** significance at 5% and * significance at 10%.