

The urban subcentros, the land use and CO₂ production

Analyst of the Metropolitan area of Barcelona

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Introduction

In urban economics theory, the activity index has been measured based on the quantity of workers in the zone and the land-use density. In general, most of the studies in the field of the urban land economics incorporate these indicators as input for evaluating the urban structure, the identification of urban subcenters and the definition of mobility patterns. Urban subcenters are territorial concentration of workers and in that sense; they define the urban mobility patterns over a metropolitan area. However, there are more possibilities to identify them.

This paper proposes a new definition of sub-centers. Density of workers is complemented with the observation of four approaches for the analysis of the Barcelona Metropolitan Area. These four approaches are the urban lands patterns (based on CORINE land cover information), the mobility of workers (from data of the Spanish Census), electric consumption (from information of the electric companies) and the estimated CO₂ production. Consequently, the urban structure will be defined based on these four approaches, which also will validate the previously defined 15 subcenters of the Barcelona Metropolitan Area.

State of art

A subcentre is a point in the metropolitan area characterized not only by having a density significantly higher than the workers of their neighbours, but above all, by being able to exert an influence on their surroundings. This influence can be reflected by the flow of workers and shoppers who visit him from their residences, or by a modification of the mantle value and intensity of land use around it. A subcentre, should also be a reference point in the territory with an identity that can be recognized for their neighbourhood, but not incorporated the environmental aspect for this urban structure.

Since the early spatial models such as Von Thunen, 1826, to those of Krugman and Fujita, self-organization of space has been raised through the integration of three closely interrelated processes, namely:

- 1) The formation of spatial rent of land,
- 2) The configuration of land uses, and
- 3) The intensity of use of space.

Value, use and density are, therefore, the three sides of a coin, in which background underlying transport costs and time spent to overcome space and agglomeration externalities, as emergent property, arising from the concentration of locators.

In the literature there are two families of methods designed to detect sub-working (see the excellent state of the art made by Muñiz, 2003, Roca et al. 2010, and Aguirre 2011)[1][2][3]. The first analysis of the density distribution (eg : jobs / urban area) and the second is functional and is based on analysis of mobility (eg home-work).

Roca, Muñiz and Aguirre[1][2][3] established a classification of methods based on the criteria for identification, since the functions of density, but in both cases differ in their analysis by different approximations. Roca and Aguirre [1] presents a striking conclusion to associate the identification of subcentres based on the mobility between home and work.

In a critical review of the state of the art, is:

a.-The specialization of the methods is also a subject of controversy. While it is an advantage that technique, including econometric models, it is very difficult to apply to several different realities. In fact, McMillen[5] acknowledges that the fashion method Gulianno and Small[6] or Garcia Lopez[7], is the easiest to use when you want to compare cities.

b.-In all works from the urban economics, classic, does not consider the environmental aspect in order to identify or validate the urban subcentres, in these terms, the industrial agglomeration and the economic agglomeration are important of the central values.

This paper deals to related these dynamics of metropolitan considering environmental standards which are: Electricity standards, land used and estimation of CO₂ production.

The case, methods and data

Our case study is the metropolitan area of Barcelona; this has 164 municipalities, 3,200 square kilometres, 551 square kilometres artificial. We carried out a cross to the information of workplaces are located at the level of municipalities, obtained based on the mobility of labour found in the Census of Population and Housing, conducted by INE in 2001. A set of subcentres has been identified [4], in this study conducted for the vectorial density workers and the parametric exponential methods.

The data collections has taken place from different sources the urban land use from the CORINE land cover (2000), the electric consumption data has been gathered from the enterprises in charge of electric distribution of the Metropolitan area of Barcelona. All data existing are the zone of work to 158 municipals continues; defined the centre business central is Barcelona borough.

Discussion

Patterns of land use and electrical consumption, is considered an array of municipalities with land use as Corine, (the code artificialized 1 soil), the power consumption of the 17 Activities sectors identified for INE, adding residential consumption and street lighting. We performed a principal components analysis which delivers 5 significant components. The component number 5, summarizes the structure of industrial, commercial and compact metropolitan areas. This pattern, there are a cluster analysis of the municipalities as power consumption parameters of the municipalities, as a measure of size or amount of activity.

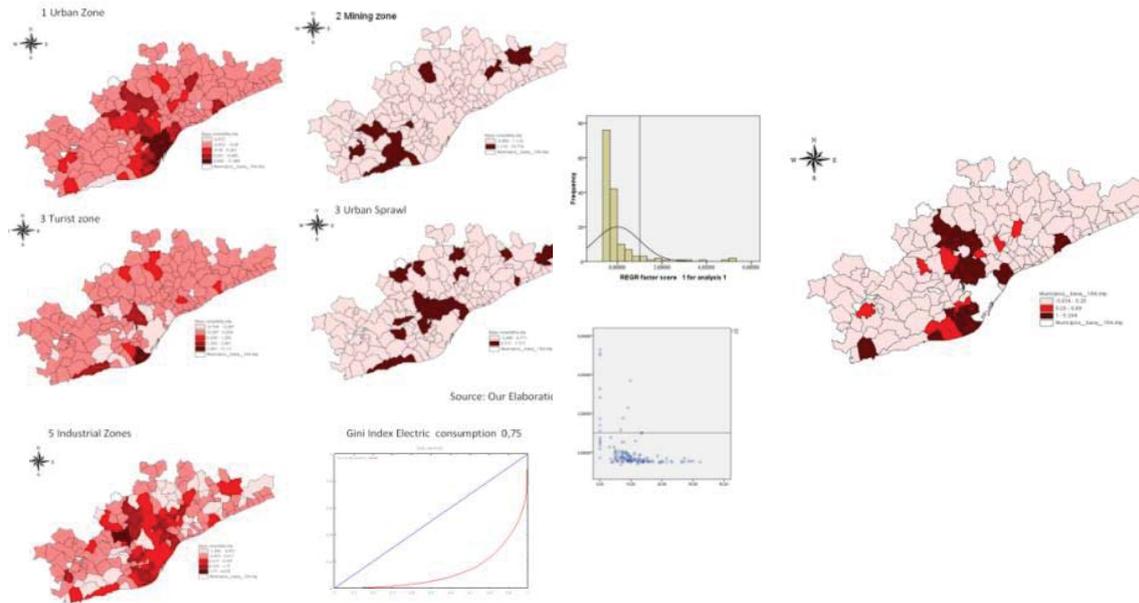
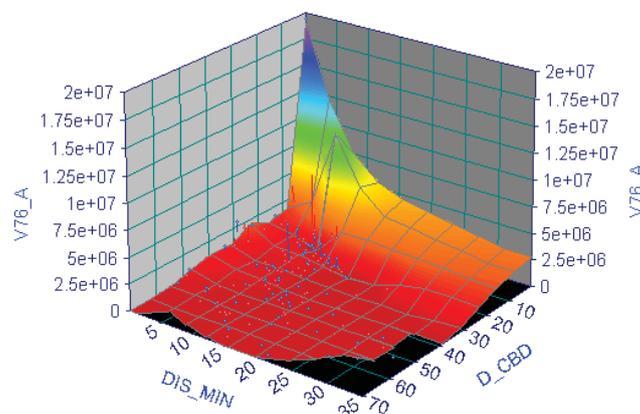


Figure 3: Analysis of component 1 of the industrial / commercial and compact land use and electrical consumption.

This component is obtained with an excellent measure of centrality and also of the sub. While this allows the identification of sub-centers, however, fails to differentiate the sub near the CBD or the more mature subcentre[4].

In the second analysis consisted in estimating a non parametric model that takes as a working hypothesis that the distance to the CBD and subcenters are inverse exponential relation to consumption of urban land.



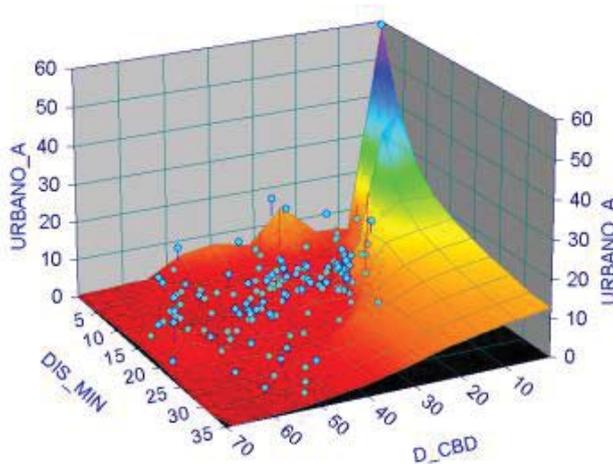


Figure 3: Estimated areas for both variables

In the first approach, establishing two curves adjustment with good results, showing in Figure 3, the sub locations to effectively raise the curve in a positive way. In a Table 1 is the OLS estimation, where the equation has an adjusted Pearson coefficient 0.622; the coefficients are significant and industrial use only a small amount of multicollinearity

	β	t	VIF
Constant	12,24	44,44	
% land Industry	0,752	8,49	2,22
% land Construction	1,739	2,09	1,14
% land Systems	-0,443	-2,67	1,76
%land Minery	0,677	2,26	1,07
Distance of CBD	-0,017	-2,55	1,49
Distance of Subcentre	-0,056	-3,88	1,38

Table 1: Ordinary least squares regression for the natural logarithm of the municipal electricity consumption

The third analysis is for the estimation of an equation that seeks to explain the aggregate output of CO₂ per municipality. While it is a first approximation, in future work we hope to develop, analyse a level the fees for different types of occupations. In analysing, “the spatial mantle”¹⁹ of CO₂ production at the municipal level, it appears that several sub municipalities raise and deform the plane obtained, as also the municipalities surrounding the sub act as major irregularities, which leads us to establish that the measure aggregate production of CO₂ is undoubtedly a summary measure of the occupation of territory in terms of employment, residence and

¹⁹ Or distributing spatial of CO₂ estimated

tertiary economic activity. While this is not new, it is possible to establish measures to measure this impact.

CONCLUSION

While the economic literature has not considered quantitatively mobility and environmental aspects, these by themselves, allow the validation of subcenters, but not so identified. It is important to establish that the obtained models belong to the Barcelona metropolitan region, with, in all studies on it, a polycentric composition, making it necessary extrapolate this analysis, as far as available data allow more monocentric realities.

Also, the new aspects are important to the consolidate theory of the urban structure, and the creation of the political framework to aboard this metropolitan themes.

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