A STATE INTERVENTION MODEL IN URBAN REGENERATION: DEVELOPMENT AND INTERNAL COHESION

Roberto Cervelló Royo

Faculty of Business Administration and Management, Economics and Social Sciences Department, Polytechnic University of Valencia, Camino de Vera s/n, 46022, Valencia, tel. 963877007 ext.74710; rocerro@esp.upv.es **(Contact author)**

Rubén Garrido Yserte

Faculty of Economic Sciences, Applied Economics Department, University of Alcalá, Antiguo Colegio de Mínimos, Plaza de Victoria, s/n, 28802, Alcalá de Henares (Madrid), tel. 918855193, ruben.garrido@uah.es

Baldomero Segura García del Río

Faculty of Business Administration and Management, Economics and Social Sciences Department, Polytechnic University of Valencia, Camino de Vera s/n, 46022, Valencia, tel. 963877007 ext.74710; bsegura@upvnet.upv.es

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ABSTRACT

This work provides an analysis and an optimization model of the spatial impact for the externalities derived from the state interventions in terms of urban regeneration and rehabilitation of degraded and segregated historic areas. From the amount invested and state intervention locations, an impact index is put forward. The spatial distribution of these impact indexes in the interventions' area of influence will be the basis for the analysis; hence, by setting some specific objectives of the decision agent about this distribution homogeneity and with the aim of avoiding inner segregation and facilitate the development and cohesion of the neighborhood as a whole, we propose a model which will allow us to allocate the budget available among the different locations fixed a priori. By means of a comparison between the spatial distributions of impact indexes obtained in both situations, a measure of the intervention process and its impact can be obtained.

Key words:
urban regeneration, segregation, state intervention, public investment, impact indexes

1. INTRODUCTION

The historic centres of some European cities have undergone a gradual degradation and segregation process which speeded up in the second half of the last century. The causes of this degradation have been analyzed in depth by several authors, both from the urban development standpoint and the economic and social sides, being this last one the most incidental and fundamental when planning a series of state interventions in a degraded, segregated and marginal area.

In Schelling's dynamic models (1971a, 1971b and 1978) the individuals preferences are set regarding the neighborhood area in which he is going to live, in such a way that he will move to or remain in a determined area depending on the neighborhood configuration. Thus it seems reasonable an individual will not reach his level of "happiness" in a degraded area and as a consequence of its neglect a worse deterioration of urban environment will take place, due to both the lack of upkeep and the lack of new investments in public goods and facilities.

Over the last few years local governments in these cities have got under way schemes for urban regeneration and rehabilitation of those areas, particularly in the degraded urban areas closest to the central districts. This has been done not only to improve the urban environment, but also to satisfy the demand for housing in cities in an expansion situation, in order to avoid the sprawl effect - uncontrolled growth on the outskirts of the city (Glaeser and Shapiro, 2003). In most cases these rehabilitation plans envisage joint action between the public and private sectors, in order to recover these areas, so as to arouse greater residential, commercial, leisure and even tourist interest. Mattos (2000) states the main aim of public policies will be, in last instance, to contribute to generate an attractive economic environment for private investment.

The evaluation of this urban regeneration programs is a complex issue given that several aspects are concerned: urban, cultural, social and economic among others. Furthermore, the beneficial effects result in externalities which have an impact on both the property and the economic activity in the area. This impact is potentially quantifiable particularly insofar as the housing demand is concerned: the increase in demand is materialized in more promotions of newly built houses, more rehabilitation work and also in a rise in the market values of property. Paul Lawless (2004) analyzes and evaluates the results from the ABI (Area Based Initiative) announced in 1998 “New Deal for Communities” in at least five aspects: crime, education, health, worklessness and housing.

Optimal location models for state interventions could cover several objectives, even multiple objectives; in this case, we will try to study the public investment assignment among the different interventions, in search of the most homogeneous impact for the neighborhood and the set of possible locations as a whole. Assuming these interventions will generate a series of positive externalities, we will try to look for the minimum variability situation in which externalities will equally benefit all the neighborhood areas, providing a greater cohesion and avoiding its internal segregation. For this purpose, a model was designed in order to study the effect of the public investment assignment among the different locations in a determined area. A priority intervention area in the city of Valencia (the neighborhood of Velluters) was taken as a reference.

2. State interventions and their location: previous research

There are a large number of works dealing with the state intervention processes in urban regeneration and planning and their effect on the residential areas and neighborhoods. Thus and as it has been previously commented, Lawless (2004) studies the ABIs (Area based initiatives) and remarks three major themes which have proved central to the wider urban debate: community engagement, partnership working and the complexity of ABIs. Eden, S. and Tunstall, S. (2006) suggest how to address the ecological aspect within research and practical agendas for urban restoration projects. Focusing on urban housing policies, Murie and Rowlands (2008) underline the use of the planning system to deliver different kinds of affordable housing and the different style and density of urban housing development as a result. Furthermore, Cameron, S. (2003) studies the housing redifferentiation and population displacement effects of urban regeneration.

Gentrification and segregation (Schelling 1969, 1971b y 1972) effects have been widely studied by several authors. De Souza Briggs (1997), Blasius, Friedrichs and Galster (2007) and Joseph, Chaskin and Webber (2007) state how policy initiatives implemented in order to improve neighborhood environments all arise from the belief that neighborhoods have an important and independent effect on the well-being and life-chances of individuals. Then and from a socio-economic point of view two main fields could be differentiated with regards to urban policy initiatives in the improvement of neighborhoods: a) Existence and provision of public goods, amenities and facilities and b) externalities management (Guellec and Rallen, 1995).

Inside the first group we find works which analyze the number and optimum location of public amenities and facilities under the influence of the land market (Sakashita, 1986, Fujita, 1986 and Berliant et al. 2006), which, for example, show how households or tenants will maximize its utility when the public amenity which gives a positive service is located in the centre of the area. Similarly, if the service rendered is negative it will be located in the outskirts.

With respect to aspects which influence the property and real estate, we should distinguish the ones which are intimately linked to location from those which are not.

Yamada (1972) states there are multiple factors which condition the location or acquisition of a property inside an urban area like: a) accessibility and space, b) leisure and entertainment space and offer and c) accessibility and quality of the environment. Tiebout model (1956) states individuals decide the location of their residence as a place where they can attain a highest level of well-being and security. Royuela et al. (2006) established that the concept of "quality of life" associated with well-being is sustained on the basic supposition that the physical, economic and social setting can influence individuals' economic behavior at the same time as their individual happiness and collective well-being.

Manning (1986) introduces "the interurban household quality of life equilibrium" which states there is a part of the population willing to renounce to part of their rent in order to have a higher level of services and better environment. Thus, they increase their utility by means of spatial externalities, which are supposed to be positives.

Then and when acquiring a property, all attributes and/or location features like the neighborhood characteristics, socio-cultural level, education, security, etc. mean spatial externalities which are inherent to the location of the chosen property. Krum (1960) sets an equilibrium model in which after considering the housing attributes, the value would be explained by the neighborhood homogeneity and the existing level of services. Lynch and Rasmussen (2004) estimate the impact of the neighborhood characteristics on the real estate market, and check how the neighborhood effect on the property market start to diminish with a distance of 3-4 miles. Richardson (1977) introduces the "rent externality" component which reflects the impact of the existing amenities and services, as well as the better quality of the environment in the closest areas to central district. Whereas Ihlanfeldt (2004) justifies segregation and the existence of "ghettos" due to negative externalities of different nature like: inadequate housing keeping, citizen insecurity, racial prejudices, etc.

There is a lot of literature which deals with spatial and geographical economics and studies spatial externalities. In the case of property and real estate, externalities could be classified in three main groups: physical, social and urban desertification (López García 1992, González-Páramo and Onrubia, 1992). Physical externalities gather all positive and negative aspects which affect the property environment, like the number of urban amenities and facilities, the presence of green areas, gardens, parks etc. Social externalities gather all positive and negative aspects related to demographic characteristics of a determined area like the education level, purchasing power or ethnic population. The demographic desertification is an externality linked to the social phenomena of "filtering" and "gentrification" (White, 1984), which are likeable to take place in the central neighborhoods of the city.

The effect of externalities on the property are reflected on the well-being or discomfort they have on the individuals; in our case of study, spatial externalities obtained from urban regeneration state intervention processes, like a historical building rehabilitation for example, are considered to be positive and to imply an increase of the utility of the residents and visitors of the neighborhood.

To summarize, there is a lot of literature which deals with optimal location of public goods, amenities and/or facilities, their effects on property and the externalities they arise. As so often, decisions about the location of state interventions in urban areas are motivated by technical, urban or policy factors rather than socio-economic foundations, therefore and in general the locations fixed a priori could not be changed, whereas budget assignment to each one of the locations could be modified.

Focusing on externalities, they are not always homogeneous and generate segregation and inequality. The purpose of our work is to avoid both segregation and inequality with the aim of developing and providing a major inner cohesion in the neighborhood. From a measurement point of view, segregation is a way of grouping units, whereas inequality is not. Segregation concerns the allocation of primary units with different levels of characteristics (persons of different races, households of different incomes, etc.) among the subgroups of a larger group while inequality examines the distribution of a characteristic of the primary units within a given group, with no regard for the membership of those units to subgroups. A common measure is the level of incomes.

Gini (1921) introduced the GINI coefficient which is a common measure of income inequality and which has also been used as a measure of Segregation. Miles and Song (2009) investigate whether the city of Portland, Oregon, has been successful in creating neighborhoods at several economic levels and in avoiding the creation or maintenance of high-poverty areas.

The aim of this work is to get the increase of utility and positive externalities to be the most homogeneous for the neighborhood as a whole, in order to avoid the maintenance of these high-poverty areas inside an only neighborhood and to obtain a more homogeneous development and a better internal cohesion. For this purpose, we try to stream the public investment among all the intervention locations inside the neighborhood, situation which will be determined by the greater uniformity and, therefore, by the minimum variability of the impact index which is going to be calculated.

This impact index will depend on the location and amount of public investment made. One possibility would be to measure by investment per surrounding (circular) area/surface of influence, assuming that the public service or improvement generates non-saturable assets (e.g. public places), for whose consumption no displacement is required and which equally affects all the housings comprised in the zone. Thus and taking the rehabilitation of a building front as a example, it increases the utility of all resident and passer-by population of the area, without producing a saturation in its use or enjoyment, even though this effect diminish while moving away from the intervention location. It should be taken into account most of the interventions of the studied neighborhood were carried out with the aim of improving public spaces and monuments without a clear bound or at least explicit in their use or enjoyment.

Thus, the index calculated basically consists of the assignment of a given attribute over the surrounding (circular) area; following a similar approach to the law of Clark (1951), based on the assumption that urban density decreases as we move away from the city centre, and the spatial density indexes introduced in the works by McDonald and McMillen (2000) and McMillen (2004). Derycke (1983) and Bailly (1978) also introduce a mathematical model in which population density is related to the distance to the city centre.

It should be taken into account that investments are relatively recent and taking into account state intervention areas are not isolated, it could be assumed that interventions in adjacent areas could also influence the neighborhood. In this case of study, we will consider that not only for the distance (Lynch and Rasmussen, 2004), but also for the period of time in which the study was carried out, those effects are considered constants and with no influence on the studied area.

3. Proposed model

Thus and in order to calculate the impact index we will assume a discrete space with N possible points of location of interventions in a particular area of the city and M locations or sub-areas (zones) of influence, as well as an $(\boldsymbol{I})$ vector, N-dimensional, whose I_j elements are the economic value of the investment made at the point of intervention j.

This vector I will generate an impact index Y_i at each location or sub-area (zone) of influence $(\boldsymbol{Y})$: will be used to designate the M-dimensional vector with all the impact indexes. In principle we will set as our main target to get the most possible homogeneous distribution of the positive effects of externalities derived from the state interventions processes; so we could get the most uniform effect on the utility of individuals and a greater cohesion on the neighborhood development, avoiding in this way segregation and differentiation in internal sub-areas (zones). We are considering that according to the homogeneity principle and in search of spatial equity, a possible way of getting a measure of this territorial equity and comparing different situations could be carried out by means of the study and observation of the investment assignment among different locations, being able to check the variability of its effect in both scenarios ("current situation" and "minimum variability situation").

Thus and assuming the intervention effects are distributed in surrounding (circular) areas all around the neighborhood (it is supposed they generate public good/amenities non-saturable which require no movement in order to enjoy them), the impact index could be represented as

$$Y_i = \frac{I_j}{\pi {d_{ij}}^2} \qquad j = 1, \dots, N \quad , \quad i = 1, \dots, M \qquad \text{(Ec.1)}$$

where

Y_i =is the value of the impact index of the investment for the location i

I_j= is the investment value made in the intervention located at j (measured in €)

$\pi {d_{ij}}^2$= is the sub-area (zone) of influence (measured in surface unit) of the intervention located at j upon the i location, with a radius of d_{ij}

d_{ij}=is the distance between location i and location j being j a location where an intervention has taken place, with $d_{ij} \neq 0 \ \forall ij$, with the aim of avoiding null distances.

π= constant (3.14159…)

Considering the effects of all the neighborhood improvements in a location i for each one of the N locations of the interventions are aggregated and, as we have previously commented, the effects of adjacent areas are constant.

$$Y_{i\, agregated} = \sum_{j=1}^{N} \frac{I_j}{\pi {d_{ij}}^2} \qquad \text{(Ec.2)}$$

As we have considered as our main target the impact index vector to be as much homogeneous as possible, in other words, to get its minimum variability, which can be measured by the variance of the elements of the vector $(\boldsymbol{Y_{agregated}})$ whose average index is $\bar{Y} = \frac{1}{M}\sum_{i=1}^{M} Y_{i\ agregated}$

$$V(\boldsymbol{Y_{agregated}}) = \frac{1}{M}\sum_{i=1}^{M}(Y_{i\ agregated} - \bar{Y}) \qquad \text{(Ec.3)}$$

Thus, the model enabling us to find the distribution of the budget assigned to the interventions which provides the minimum variability to the impact vector and, therefore, its greater uniformity would be

$$Minimize \quad = \frac{1}{M}\sum_{i=1}^{M}(Y_{agrrgated} - \bar{Y})^2 \qquad \text{(Ec.4)}$$

subject to

$$\sum_{j=1}^{N} I_j \leq B$$

$$\bar{Y} \geq k$$

$$I_j \geq 0 \qquad \forall j = 1, \ \dots \ , N$$

Being B the total budget assigned to the intervention and k is a minimum value of average impact of the investment; in this case, k corresponds to the average index obtained $\bar{Y}$ with the assignment of the investment in the "current situation" , and it could be considered as a measure of the well-being obtained in this situation; it will also represent a threshold/line to get in the "minimum variability situation", being our aim the average impact index obtained in this situation of major uniformity and cohesion to be equal or even higher than the "current situation" one. Thus, for the same budget B and with this treshold/line k it could be guaranteed that the average impact of the positive externalities for the neighborhood as a whole in the "minimum variability situation" would be, at least, equal to the "current situation", which in our area of study (Velluters) will have a value of 38,284,176.10€ and 126.24€/surface unit respectively.

4. Case of study. Velluters neighborhood (Valencia)

The city of Valencia is the third largest city in Spain with a population of 814,208 people in 2009 (INE, 2009),). During last years it has undergone a wide expansion, development and growing process which lead to undertake a series of urban interventions with the aim of recovering the historically traditional and most degraded areas like the Velluters neighborhood. The present Velluters district (also known as the "Barrio del Pilar") is located in the District 1 of the city of Valencia, known as Ciutat Vella. Its origins are not known very exactly, but this used to be a craftsmen's quarter with a simple urban layout located between the western limits of the Moslem and Christian city walls, at present surrounded by the other Ciutat Vella neighborhoods (Figure 1).

Figure 1. Map of the "Velluters/El Pilar" districts

Source: Valencia CIty Council Statistics Office

In the 19th century the historic events which affected the fabric of the district to a greater or lesser extent took place, with it beginning to fall into decay and be largely overlooked. Provoking its segregation with respect the rest of the Ciutat Vella neighborhoods, it turned to be one of the most underprivileged areas of the historic centre with a marginalized and ageing resident population.

In view of this evident degradation of the historic centre, the city council and the regional goverment signed an agreement of joint intervention in order to develop the RIVA Plan (Plan de Rehabilitación Integral de Valencia), a plan for the comprehensive rehabilitation of Valencia, in which the Velluters neighborhood was one of the main areas of intervention. The main objectives of the plan were the following ones:

·To revitalize the historic centre.

·To keep the population which inhabits the historic centre and to attract new inhabitants.

·To improve the quality of life of residents by means of the quality of the services.

·To create social, cultural and educative services, focused on the most degraded and marginal areas of the city.

·To improve the integration of historic centre in the city on the whole as differences in amenities and facilities provision are equilibrated between the historic centre and other more recently created areas
·To give an incentive to private initiative in order to rehabilitate the residential heritage.
·To give an incentive to build brand new buildings.

At the present time the general panorama in the neighborhood is different, starting to be chosen as a centre for activities both for certain businesses and for public and private institutions. The main improvements in the Velluters neighborhood, have taken place in the urban sphere. However, there is a series of indicators which sign a general improvement in the quality and environment of the neighborhood like:

·An increase in the population from 3,861 (1996) to 4,067 (2009), reaching to gather the 15.69% of the whole population of Ciutat Vella (District 1) and the 3.18% of the whole population of Valencia city in 2009.
·The change to service economy and change in the activity of the neighborhood which in 2009 was comprised in a 62.3% by commerce and services, in a 29.8% by professionals and artists and in an 8% by industrial activities.
·An increase in the brand new buildings of 2,045 since 19th century as well as an increase in selling and rent prices.

The interventions taken on the Velluters district during the 1998-2006 period can be split into two main groups: A first group of measures on service amenities (public use) and a second group of measures on property for residential use (private use) connected with subsidies received by private people for private rehabilitation (See Table 1).

Table 1. Interventions taken in the Velluters neighborhood

State Interventions in the Velluters neighborhood		
Investments in amenities and facilities (public goods)	Investment in residential assets (private property)	Total Investment
23 interventions	10 interventions	33 interventions
32,224,763.81€	6,059,412.31€	38,284,176.10€

N.B.: This table shows the distribution of state interventions in Velluters. There are a total number of 23 public interventions and 10 interventions on housing. All the action was undertaken in the city of Valencia from 1998 to 2003.

Source: Plan RIVA

To make the space in the district discrete we divided its total surface area into a grid of roughly block-sized squares (locations) of 50x50m. This thus divided the west-east axis into 9 units and the north-south one into 19, with 171 squares in all, covering the total surface area and being able to measure both the investment and the impact index in the centre of each concrete block-sized square. The 33 original locations of the interventions are kept, since this is a decision already passed by municipal authorities. Thus, the vector $(\boldsymbol{I}) = [I_1, \dots, I_{33}]^T$ has a dimension of N=33 and the vector $(\boldsymbol{Y})(\boldsymbol{Y_{agregated}}) = [Y_1, \dots, Y_{171}]^T$ has a dimension of M =171.

It will be supposed effects inside a concrete block-sized square are homogeneous and, therefore, equally affect the whole concrete block-sized square area. With the initial investment distribution we have obtained a “current” distribution for the impact index generated, getting an average initial value. A more homogeneous distribution (“minimum variability”) could be obtained, without the result as a whole being worse than the initial one ("current situation"). This result will be measured by the average index value which should be higher than the one obtained for the "current situation" (126.24€/surface unit).

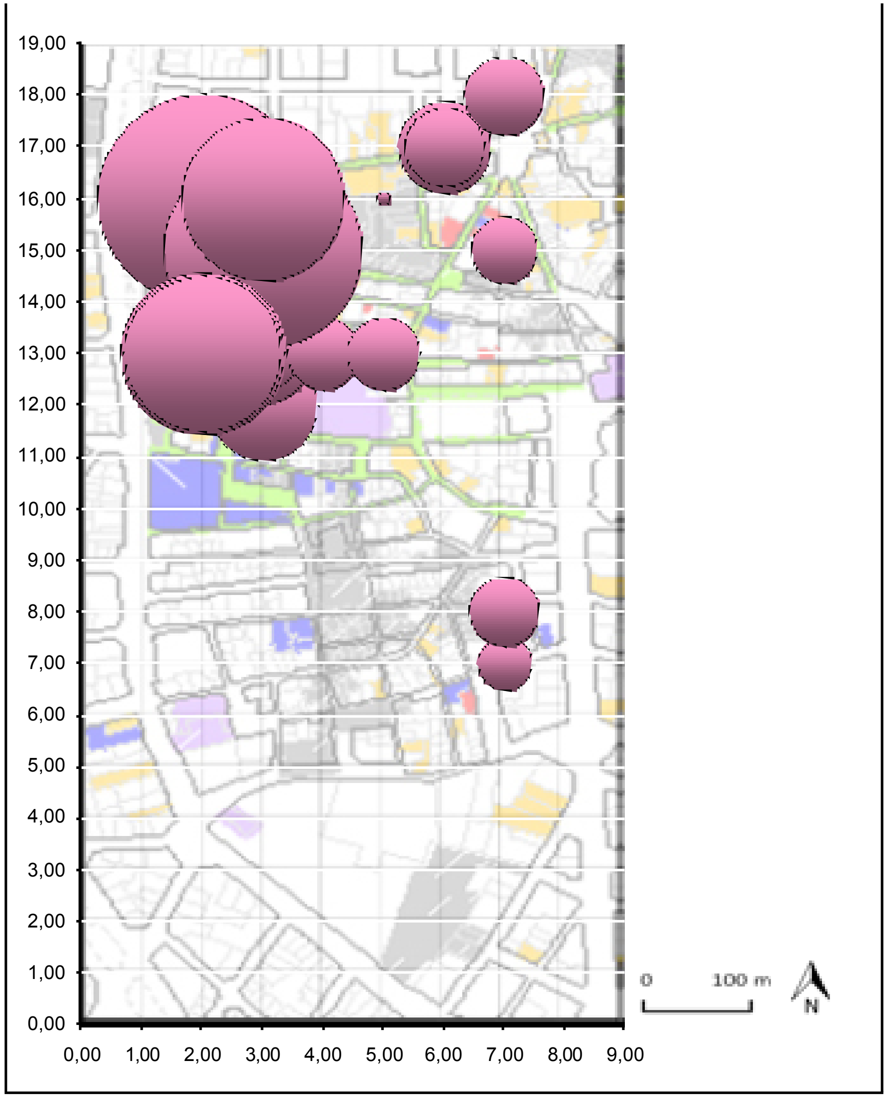
If we locate the 33 investment on a plane and represent these by means of a map symbols (circles) which are proportional to the corresponding investment, we could locate and give them a specific weight as it can be checked in Figures 2 and 3. Figure 2 shows the "current situation" and Figure 3 shows the investment distribution for the "minimum variability situation", whose average impact index is of 126.77€/surface unit (higher than the 126.24€/surface unit obtained for the "current situation") with the same budget B and the same locations j .

As regards the distribution of impact vector $(\boldsymbol{Y})$ $(\boldsymbol{Y}_{agregated})$ major differences can also be seen (Figure 4). For the "current situation" the highest values of the impact indexes are concentrated in the blocks close to the interventions executed, with considerable differences between the closest squares as opposed to the ones that would have been provided by the "minimum variability situation", where the distribution of the index is quite a lot more uniform. Lastly, Figure 5 shows the relative difference existing between the distribution index for the "current situation" and for the "minimum variability situation". As one can see, for this minimum variability situation, the distribution of the index is quite a lot more homogeneous, favouring the zones which are hardly benefited for the current situation.

This formulation is obviously not the only one possible. The model could be extended in two directions. We can firstly incorporate conditional restrictions requiring minimum public investments in certain zones or for the impact index in certain zones to reach certain values in order to attain particular objectives set by public authorities in the intervention process.

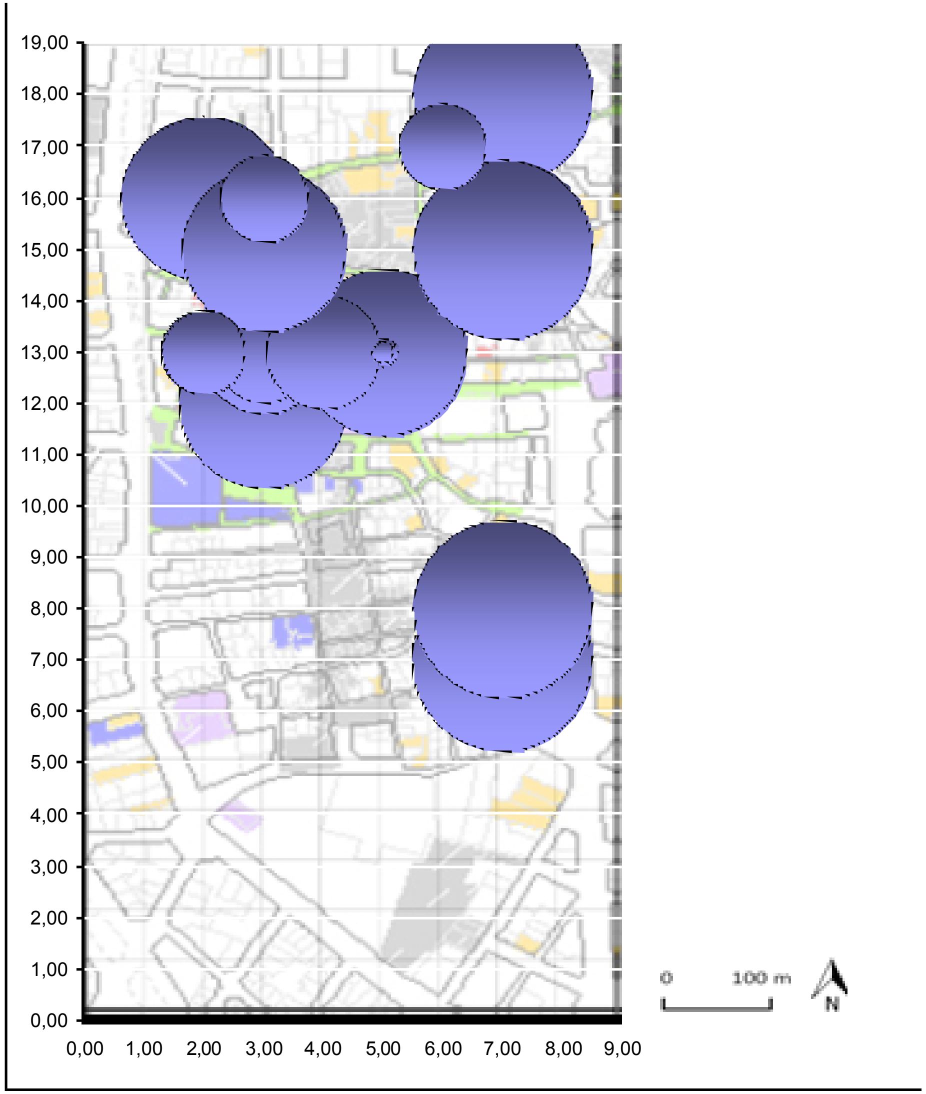
On the other hand, the model could also be extended in order to obtain the endogenous location of the intervention zones, simply by extending vector I to all the squares in the district instead of only 33, though in this case we would have to use a different impact index, as some of the d_{ij} would logically be null. Endogenous location does not nevertheless make much sense for the type of interventions that we have analyzed, since the initial situation of the district will be what conditions the location. In other types of services (education, health or emergencies) endogenous location could make some more sense.

Figure 2. Density of the investment: current situation



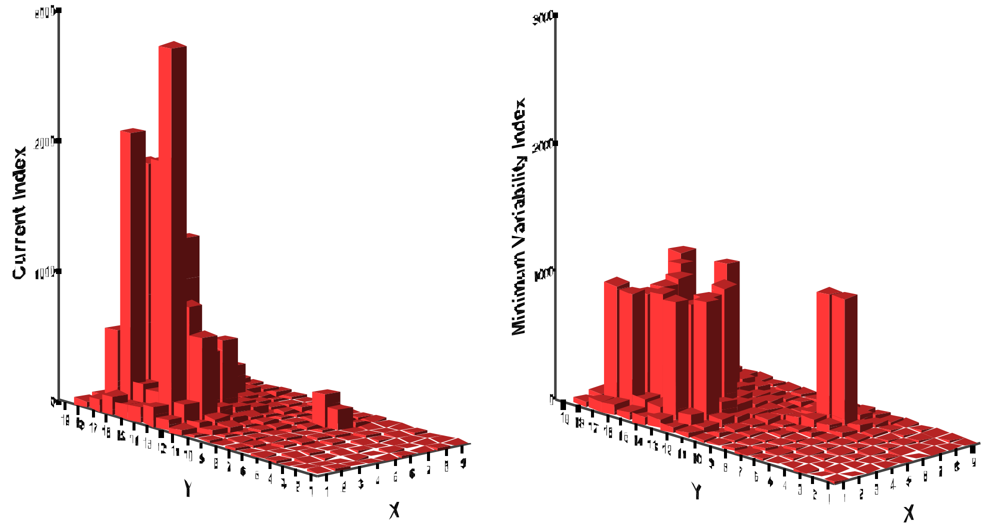
Source: Authors' elaboration

Figure 3. Density of the investment: minimum variability situation



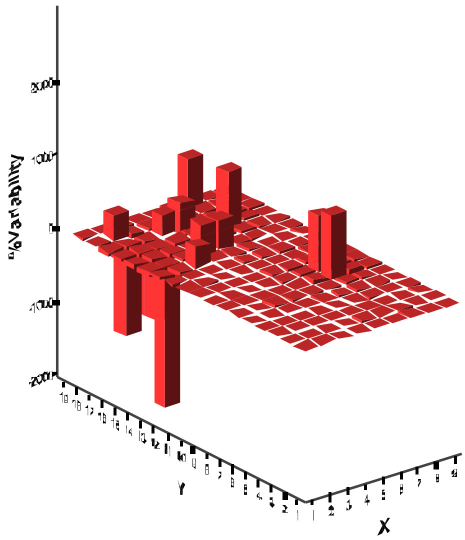
Source: Authors' elaboration

Figure 4. State intervention index. Post-intervention analysis: current situation vs. minimum variability situation.



Source: Authors' elaboration

Figure 5. Variation of the state intervention index between the current situation and the minimum variability situation.



Source: Authors' elaboration

5. Conclusions

A model is put forward whose main target is to get a greater homogeneity for the positive effects derived from the externalities with the aim of getting both a better development and an internal cohesion in the neighborhood as a whole, by means of a redistribution in the assignment of public investments among the intervention locations; this target is obviously not the only one possible, even multiple objectives could be considered. As we have also summarized at the model estimations some constraints about the nature of the intervention or their expected effects at determined locations could also be introduced.

The model allows comparing different situations and, therefore, we can conclude structures more sensitive to the environment and with greater flexibility are required; it could be useful when setting strategies in the field of urban planning.

The results obtained show that (i) for the same number of locations the structure obtained for the investment vector I is very different to the initial one; (ii) exceeding the minimum value established, the distribution obtained for the impact vector Y ($Y_{agregated}$) in the "minimum variability situation" proves much more homogeneous and provides a higher average impact index (iii) this more homogenous distribution favours the most segregated and less benefited sub-areas (zones) in the "current situation", providing a greater internal cohesion and better development for the neighborhood as a whole, with the consequent improvement in the level of well-being for the whole district and thus of the quality of life and utility of individuals, presupposing that all the changes arising and endowments stemming from the processes are positive. On the other hand, the model can be extended either by introducing conditional restrictions or by considering endogenous locations.

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