The Usage of Cadastral Information for the Formulation of Environmental Policies – Social Evaluation of Welfare's Losses and Profits due to Externalities[1]

Jose Antonio PINZON BERMUDEZ, Colombia

Key words: Welfare Economic, Hedonics Prices, Cadastre, Valuation, Externalities, Geographic Information System.

SUMMARY

The main object of this research is to prove the importance of Cadastral Information to for the formulation of public policies. The study demonstrated that with the usage of physical and economic information of the land, we can establish the theoretical basics for appraisal; on the one hand, the society's loss of welfare due to environmental pollution and on the other hand, the profit in welfare caused by an improvement in the quality of people's life. In order to achieve this objective, we used the tools offered by Welfare Economic and Geographical Information System - GIS.

RESUMEN

El Propósito principal de esta investigación es demostrar la importancia de la información catastral para la formulación de políticas públicas. El estudio, demostró que con la utilización de la información física de los predios y la información económica de los mismos, se pueden establecer las bases teóricas para estimar de un lado, las perdidas de bienestar de la sociedad por efecto de la contaminación ambiental, y del otro, las ganancias en bienestar por efectos de una mejora en la calidad de vida de las personas. Para lograr dicho objetivo se usaron las herramientas que ofrecen la Economía del Bienestar y los Sistemas de Información Geográfica - SIG.

RÉSUMÉ

Le but principal de notre recherche est de montrer l'importance de l'information cadastrale dans le processus de formulation des politiques publiques. L'étude a montré que grâce à l'utilisation des informations physiques et économiques sur les sols, il est possible d'établir les bases théoriques permettant d'estimer d'une part, les pertes au niveau du bien-être social en lien direct avec la pollution de l'environnement, et d'autre part, la plus-value en bien-être, du fait de l'amélioration de la qualité de vie des personnes. Pour atteintre notre objectif, nous sommes servis des outils que nous proposent l'Economie du bien-être et les Systèmes d'information géographique.

[1] Special thanks to Beatriz Quintero, Erika Ortiz and Paola Cala for their contributions and comments to this paper.

The Usage of Cadastral Information for the Formulation of Environmental Policies – Social Evaluation of Welfare's Losses and Profits due to Externalities[2]

Jose Antonio PINZON BERMUDEZ, Colombia

1. INTRODUCTION

The design and implementation of public policy, not only based on aspects of political nature also is a vital importance take into account economic considerations; the natural resources and the environment should not be the exception. Therefore, in order to optimize the use of the natural resources offered by nature to us, it is important to consider the profits and/or the social costs of any decision. This will allow the formulation of right environmental policies considering social and economic aspects.

Consequently, in order to obtain the implementation of any policy, such as a conservation or preservation of natural resources policy, an air or water policy or parks policy, it is necessary to determine the benefits that these policies generate to individuals and society in general. The Welfare Economics is the instrument at hand to make this kind of researches.

To achieve these purposes and taking into account the heterogeneity of the scientific community of the F.I.G., in first instance, we will clarify some theoretical aspects related to the method of Hedonic Prices. This method was used in the case studies analysed in this paper to assign a value for the externalities accounted. Additionally, we will show some definitions and important aspects of the Colombian cadastre.

In second instance, we will show three researches carried out in Colombia, where using cadastral information was possible estimated welfare's loss and profits in the society with the purpose to formulate recommendations of policy for the environmental sector from academic sceneries.

Finally, the paper will show some conclusions that in opinion of the author should be used as a reference in the formulation of policies for the production of cadastral information, in particular, with the purpose of formulating environmental policies.

2. HEDONICS PRICE

2.1 Theoretical Principles

The basic premise of the hedonic prices method is that the price of a marketable good is related to its characteristics or with the services that it provides. Then, the main idea is to

[2] Special thanks to Beatriz Quintero, Erika Ortiz and Paola Cala for their contributions and comments to this paper.

value the individual characteristics or services of the object studied; observing how people's willingness to pay change as the characteristic changes. By the intrinsic characteristics of the hedonic prices method, generally, it is applied to the housing market.

Attributes like a beautiful landscape, a quiet and safe neighborhood, the closeness to beautiful parks or to have good route of access are characteristics that from the theoretical point of view influence positively the value of the housing. On the other side, the proximity to a landfill, or to industrial areas, by the level of environmental pollution, has a negative effect.

Both, positive and negative attributes are those that generate losses or profits of welfare on individuals and society. They can be quantified indirectly through the consumption of a private good, such as housing.

2.2 Formulation Models

Hedonic Prices´ method is formed by the idea that consumers generate satisfaction by consuming a private good, in this case, housing; which can be represented by a vector $Z = (z_1, z_2, z_3, ..., z_n)$ of house's own structural characteristics (building area, construction material, communal zones, etc) and a vector $A = (a_1, a_2, a_3, ..., a_n)$ of neighbourhood surroundings attributes, school buildings, parks, shopping centres, security/safety, environmental characteristics, etc). Housing's market price is in function to characteristics and attributes of the product.

$$P = P(Z, A).$$

Hedonic equilibrium is determined by maximizations of utility and profits reached by consumers and producers, respectively and the interaction between themselves.

2.3 Microeconomic Principles

When families choose a house, they choose a vector Z, for house's own characteristics and a vector A of attributes. The consumer goods remaining are represented by vector X, also know as numerary good or compound good, in Economy.

On the consumer side, another element to consider is the budget restriction or home income level, which is represented by Y; which can be spent in housing or in compound good X. Housing spent is in function of housing hedonics prices $P(Z, A)$, which measures the equilibrium relations between housing prices, Z and A, due to the socioeconomic characteristics α. Therefore, home preferences are represented by an utility function.

$$U(Z, A, X; \alpha).$$

Utility maximization problem in families are:

$$\text{Max}_{Z,\,A,\,X}\ U(Z,A,X;\alpha) \quad \text{s.a}\ \ P(Z,A)+X=Y\,.$$

Solving this problem we obtain the bid function $\phi(Z,A,Y,U;\alpha)$ of consumers, which represents the consumer's "willingness to pay" – WTP a house with its owns characteristics Z, surrounding attributes A, a home income level Y, and the consumption of other goods and services represented by X, due to socioeconomic characteristics α.

In the other hand, builders must choose the type, as well as the quantity of houses or apartments to build. Producer's cost function can be represented as $C(Z,A,N;\beta)$, where N is quantity of produced units, and β represent a vector of specific technology and price factors. Therefore, the problem of net profits maximizations of the producers that takes the price as given is:

$$\text{Max}_{\ Z,A,N}\ \ \pi = NP(Z,A) - C(Z,A,N;\beta).$$

From this problem we obtain the supply function $\rho(Z,A,N;\beta)$ which represents the unitary price that a builder or a house seller can accept for a house, with characteristics Z and attributes A. First order conditions are required that the marginal price to each characteristic has to be equal to marginal cost for unit, which increase the quantity of that characteristic. The product level must balance its price with its marginal cost, this is:

$$\frac{\partial P}{\partial Z_i} = \frac{\partial C}{\partial Z_i}\,.$$

Equilibrium set is determined by the interaction between consumers and producers. In order to understand this, we can say that the interaction works as a kind of bid, where the producer offers and the consumer bargains and the equilibrium point is established where consumers, as well as producers (housing suppliers), maximize their utility and profit; then only the exchange occurs.

3. COLOMBIAN CADASTRE

3.1 Cadastre definition

Law 14, 1983, defined cadastre as an inventory of multiproposal profile. With this, it tried to give to local authorities the adequate instruments for local planning. In the regulatory decree of Law 14, is established that *"Cadastre is the inventory or census, properly up-dated and classified, of the real-state belonging to the State and private sector, with the purpose of achieving its correct physical, legal, fiscal, and economical identification"*.

Due to great information volume of distinct cadastre offices, they started the labor of systemizing cadastral information. Main cities of the country have their own Cadastral Information Systems, in digital format.

3.2 Colombian Cadastre in numbers

In Colombia, there are 11'762,560 lands nowadays, which 8'468,322 are urban type (72%) and 3'294,238 are rural type (28%); 67% of the total sum of the lands are managed by the IGAC, while the 33% remaining are managed by decentralized cadastral offices. The cadastral office of the Colombian capital manages 15% of the lands of the country.

Table 1: State of Cadastre in Colombia, 2003

Entity	Total Lands*	%	Urban	%	Rural	%
IGAC	7.851.306	67%	5.025.619	59%	2.825.687	86%
Antioquia	984.873	8%	588.242	7%	396.631	12%
Medellin	663.239	6%	632.213	7%	31.026	1%
Cali	537.980	5%	513.396	6%	24.584	1%
Bogota	1.725.162	15%	1.708.852	20%	16.310	0%
Total	11.762.560	100%	8.468.322	100%	3.294.238	100%

Source: IGAC, Decentralized cadastral offices. Estimated DNP-DDUPRE. * Established land.

Finally, it has to be remarked that if cadastral information in Colombia is essential for local financing, it is also true that it has been used for development planning. In later years, it is considered as a basic input for academic community, specifically in scientific research, as it will be seen in the next chapter.

4. CASE STUDIES

4.1 Atmospheric Pollution

4.1.1 Case Presentation

Carriazo (2000) started from the hypothesis that air pollution (by suspended particles), being a negative externality, leads to a loss of value in the houses of Bogotá. As a logical consequence it produces a loss in welfare of society. In order to prove this hypothesis and to estimate loses of welfare of society; he based his research with several sources of information, primarily on cadastral information produced by the Administrative Department of Cadastre of Bogotá.

For the date in which the research was carried out (1999) of the 999,510 housings in the data base 661,393 were houses and 338,117 were apartments in horizontal property. It is important to stand out that only housing information was used because it was the main purpose of this research.

Based on the total population (total number of housings in Bogotá) and with the support that offer the statistical techniques to construct econometrics models, the following activities were developed: i) sample size was calculated, ii) the sample was chose in a random way, iii) inconsistent data were eliminated, iv) tests of statistical validation were elaborated, v) using GIS evaluated the consistency of the sample from space's point of view, vi) econometric models were constructed, and, vii) analysis of results was done.

4.1.2 Definition of Variables

- *Avalúo***:** Cadastral valuation, continuous variable that represents the valuation in million of Colombian pesos of 1998 according to Cadastre Bogotá. It is estimated based on the additions of partial valuation done to the lots and constructions of the land, according to valuation procedures and methodologies designed with this purpose.
- Punt: Score, "proxy" variable quality of the housing. A group the physical description and the intrinsic characteristics of housings such as structure, conservation building and particularities of bathrooms and kitchens.
- *Arco:* Continuous variable correspondent to the built area of the housing, measured in m^2.
- *Arte:* Continuous variable that corresponds to the lot area, measured in m^2 in which the edification is located. In the case of apartments, this is calculated according to the horizontal property coefficient.
- *Uso***:** Dummy variable which takes the value of 1 if the housing is an apartment or 0 if the housing is a house.
- *Dust:* continuous variable that represents the average level of pollution caused by suspended particles (µg /m3) of the area where the housing is located.
- *Vía:* Dummy variable that takes the value of 1 if the neighbourhood in which the housing is located is intercepted by one or more main roads and, 0 otherwise.
- *Agua:* Dummy variable which takes the value of 1 if the neighbourhood in which the housing is located is intercepted by one or more rivers or wetlands, 0 otherwise.
- *Dparc:* Continuous variable that represents the density of green areas in the neighbourhood which the housing belongs to.
- *Estr:* The stratum which the housing belongs to takes discreet values (1,2,3,4,5,6), where the value of 1 represents the lowest stratum and 6 the highest one.

4.1.2 Formulation of the Model

The estimated hedonic prices function is given in general form by:

$$P(\mathbf{Z}, \mathbf{A}, \boldsymbol{\alpha})$$

Where

- **Z** vector of structural characteristic (score, lot area, built area and usage) of the housing.
- **A** vector of location characteristics (roads, wetlands, rivers, pollution, and density of parks).
- $\boldsymbol{\alpha}$ vector of socio economic variable (stratum).

Estimated econometric model using Box- Cox transformations:

$$Avaluo^{(\theta)} = \beta_0 + \beta_1 punt^{(\lambda)} + \beta_2 arte^{(\lambda)} + \beta_3 arco^{(\lambda)} + \beta_4 uso^{(\lambda)} + \beta_5 via^{(\lambda)} +$$

$$\beta_6 dust^{(\lambda)} + \beta_7 agua^{(\lambda)} + \beta_8 parc^{(\lambda)} + \beta_9 estr^{(\lambda)} + \varepsilon_i$$

4.1.4 Results

The results obtained by Carriazo (2000) are very interesting because his study is one of the first of its kind carried out in Colombia based on cadastral information. In this paper we will not show all the results from the econometric models so I do not make this paper too long, but I will make an analysis of the results of the studied variables.

The variables Punt, Arte, and Arco show us that all the variables of structure are very significant for the housing hedonic price explanation and show positive coefficients, which also demonstrate that an increment in the structural characteristics (e.g. score) leads to an increment in the housing prices.

In the case of the variable Uso, it shows a positive coefficient, indicating that consumers prefer apartments rather than houses. This could be associated with the improved conditions of security that apartments offer compared to houses in Bogotá.

The variables Vía and Agua, due to being dichotomies, are used as perception variables, for, these variables are non continuous. In these cases, the analysis of the variable sign allows us to determine if the mentioned attributes are perceived as positive or negative externalities:
The coefficient of the variable Vía resulted positive, which means that the roads could be perceived more as positive externalities associated to the access and not as negative externalities, associated to the noise, the congestion or the pollution. It is worth pointing out that this variable was significant and relevant within the model. The variable Agua was also perceived as a positive externality, positive sign. However, for the model it was not relevant.
The socioeconomic variable Estr shows a positive relationship with the price of the housing as it was expected, as the socioeconomic stratum increases, the price of the housing increases as well. This variable is very significant for the model.

The variable Dparc, did not very significant in the model, this can possibly be explained because of the way the variable was built. Dpark can be important for future researches. We will look deeply at the units of measurement, scale of parks, security and others facilities.
Finally, for the case of pollution (Dust), as it is a continuous variable, an analysis of elasticities, which determined that an increase of 1% in the emission of suspended particles lead to a decrease of 0.1263% in the price of housings. In other words, an increment of 1% in the emission of particles would produce a decrement in the value of housings of $47.731.

4.2 Parks

4.2.1 Case Presentation

Penagos (2002), based his work on the hypothesis that maintain and conserve parks and public spaces has a positive impact not only on the welfare of individuals and society, but also on the city in general because the city that takes most care of its parks becomes more competitive, fair and sustainable. For this reason, through the hedonic function, and with the support of the cadastral information used in this study she proved that the housings near to the parks, brings a better style of life for people living in Bogotá.
The methodology for the development of this research is very similar to presented by Carriazo (2000). Part of the cadastral information, design a probabilistic sample and the use of GIS allows to localize the samples, creating a series of surrounding and environmental variables that added to the structural variables allows the construction of a hedonic function. Finally she used the Box-Cow transformation for the good results in the econometric estimators.
The study shows three main problems: i) Low level of parks in many localities in Bogotá[3] where people with the lowest income are located, ii) the bad and regular level of conservation of the parks in low stratum areas and iii) the high cost that the maintenance of parks require.

4.2.2 Definition of Variables

- *Ac:* Continuous variable that corresponds to the built area in squared meters.
- *Capto:* Dummy variable that takes the value of 1 if the housing is an apartment and 0 if the housing is a house.
- *Estratoi***:** Correspond to the socioeconomic variable that indicates approximately the level of income for the family that occupies the housing. This variable is shown as a binary variable for each socioeconomic level that exists.
- *Th:* Variable that indicates the number of homicides for every 100.000 inhabitants per locality in Bogotá.
- *Npl:* Variable that indicates the number of policemen per locality for every 100.000 inhabitants.
- *Norte:* Dummy variable that indicates if the housing is located in the north or in the south of the city**.**
- *Distparq:* Continuous variable that indicates the linear distance in meters from each land to the nearest park.
- *Tipi:* The kind of nearest park, this means the kind of service that offers to the community. The park kind 1 represents a pocket park with an area superior to 500m^2, 2 represents a park of neighbourhood, 3 zone parks, and 4 metropolitan parks.
- *Arparq:* Continuous variable that indicates the area of the nearest park in square meters.
- *Inversión:* Represents a variable of the quality of the park that indicates if in the past 5 years the park has had investment, improving its quality.

[3] The term, locality, in Bogotá refers to a geopolitical level.

– *Denparq:* Represents the density of parks within 500 meters around each housing.

4.2.3 Formulation of the Model

The estimated hedonic prices function is given in general form by:

$$P(\mathbf{Z}, \mathbf{A}, E, \boldsymbol{\alpha})$$

Where:

– **Z** vector of structural characteristic (build area, type of housing) of the housing.
– **A** vector of location characteristics (homicides per locality, number of policemen, spatial location in the city).
– **E** vector of environmental characteristics (distance to parks, type of parks, area of the nearest park, investment in parks, density of parks)
– $\boldsymbol{\alpha}$ vector of socio economic variable (stratum).

Estimated econometric model using Box- Cox transformations:

$$Avaluo^{(\theta)} = \beta_0 + \beta_1 Ac^{(\lambda)} + \beta_2 Capto^{(\lambda)} + \beta_3 Th^{(\lambda)} + \beta_4 Npl^{(\lambda)} + \beta_5 Est\,3^{(\lambda)} +$$

$$\beta_6 Est\,4^{(\lambda)} + \beta_7 Est\,5^{(\lambda)} + \beta_8 Est\,6^{(\lambda)} + \beta_9 Norte^{(\lambda)} + \beta_{10} Tip\,3^{(\lambda)} + \varepsilon_i$$

4.2.4 Results

As well as in the last case, we will not going into econometric aspects, I will only show the analysis of the results starting from the premise that the chosen model was the one that showed the best behaviour.

Looking at the variables studied by Penagos (2002), as it was expected the variable built area resulted positive and statistically significant. Unlike the Carrizo model, stratum was modeled in a binarian way for each existing stratum, establishing in a quantitive way the influence per stratum in the value of the housing.

As it was expected, the homicide rate per each 100.000 inhabitants gave a negative sign with a level of significance of 95%, an important willingness to pay to improve the security level in the neighbourhood was shown. In respect to the marginal increment of the police for every 100.000 inhabitants it was estimated that the society in Bogotá is willing to pay for the increment of public force.

Another variable that also draws attention in the study with a level of significance of 95%, is that people have a great preference to live in the north of the city and their willingness to pay to live there is a lot superior to the security measures. It seems that there is a perception that living in the north of the city brings a better quality of life (better security, better infrastructure, better neighbourhood, etc) showing a bimodal development.

On the side of environmental attributes, it was possible to prove in a quantitative way and with enough statistical evidence that the nearer to a zone parks has a very positive influence in the value of the housing. The work leaves enough statistical evidence to state by the author of this article that the society in Bogotá prefers more parks rather than policemen.

4.3 Soil Erosion

4.3.1 Case Presentation

Goyeneche (2003) started from the hypothesis that the inadequate use of soil promotes an increment in erosion rates and also causes salinity problems, which bring as a logic consequence the reduction in the prices of the lots. Therefore, it is necessary to quantify the loss of soil and value its economical effects with the purpose to formulate the right public policies.
To achieve this objective, this study attempts to find empirical evidence about how the erosion and salinity affect the value of the land in the area of study. This study is also based on the methodology of hedonic prices, with an additional ingredient that his study is not applied to urban planning topics, but instead it is applied in rural field planning topics.

The GIS allowed link, information about cadastral valuation, erosion studies produced by IGAC, characteristics of soils and life quality to estimate the implicit prices for a series of physical and environmental attributes of the rural lands in Anaime- Nima- El Cerrito en el Valle del Cauca, Colombia.

To estimate the hedonic model, some econometric spatial techniques were used to include likely spatial lags in the variable Avalúo. These lags have their foundations in the methodology to estimate the cadastral valuation based on geoeconomic zones.

4.3.2 Definition of Variables

- *Avalúoh:* Continuous variable comes from the dividing of the cadastral valuation for the area in hectares.
- *Lp1:* Transformed variable. Natural Logarithms of the Avaluoh.
- *Palmi:* Dichotomic variable that takes the value of 1 if it is located in the municipality of Palmira, 0 otherwise.
- *Areah:* Total area of the land en hectares, taken from the GIS.
- *Porcon:* Percentage of the built area by the total area of the land.
- *Erotasa1:* Potential erosion rate (ton/ha-year) estimated from the Stehlik formula.
- *Eroarea1:* Percentage of the area affected by moderate or severe erosion.
- *Sal2:* Dichotomic variable that takes the value of 1 if it shows light or moderate of salinity, 0 otherwise.
- *Sal3:* Dichotomic variable that takes the value of 1 if soils are sodic and salin-sodics, 0 otherwise.
- *Bufrcau:* Distance to River Cauca, 8 buffer were created with 3 kilometres of distance between each other.

- *Piso1*: Continuous variable, which represents an average height in meters above the sea level (msnm).
- *Porcana*: Percentage of the area in the land devoted to the sugar cain.
- *Porpasto*: Percentage of the area in the land devoted to pastures.
- *Usopotzp1*: Dichotomic variable, which represents the value for the potential use of soil in a flat zone: 1 corresponds to the agrological *class I and II, 0 otherwise.*
- *Prof*: Average depth in centimetres.
- *Distk*: Optimal distance from the land to the urban area of the municipality of Palmira through the main road in kilometres.
- *Dist_via:* Distance from the road to the land in meters (1 < 100m; 2, 100m - 200m; 3, 200m - 300m; 4, 300m - 500m; y 5 > 500m).
- *Calvid3:* Dichotomic variable that takes the value of 1 if the land is located in areas with low life levels, 0 otherwise.

4.3.3 Formulation of the Model

The estimated hedonic prices function is given in general form by:

$$P(Z_i) = P(\mathbf{Z_{amb}}, \mathbf{Z_{ua}}, \mathbf{Z_{es}}, \mathbf{Z_{acc}})$$

Where:

- $\mathbf{Z_{amb}}$ Vector of environmental characteristics (presence of erosion and salinity of the land).
- $\mathbf{Z_{ua}}$ Vector of characteristics of the current usage (presence of grass and sugar cane).
- $\mathbf{Z_{es}}$ Vector of structural variables (area of lot, constructions, height and depth).
- $\mathbf{Z_{acc}}$ Vector of access characteristics (distance nearer to: i) important city, ii) main routes, and, iii) the Cauca River).

Econometric model estimated using autoregressive models - SAR:

$$\ln P = \alpha + \sum_{i=1}^{n} \beta_i Z_i + \rho W_P + \varepsilon$$

$$W_P = W * P$$

By presence of spatial autocorrelation and based on the methodology of valuation liquidation, autoregressive space models were estimated (SAR), in which were include the dependent variable multiplied by a matrix of weights W constructed with the inverse value of the distance between the centroids of lands. Where $\boldsymbol{\rho}$ is the autoregressive parameter and $\mathbf{W_P}$ is the variable with spatial lag, W the matrix of spatial weights and $\boldsymbol{\varepsilon}$ is the error.

4.3.4 Results

Of studied variables, 10 were significant and with the expected sign. With respect to the environmental variables Erotasa1 and Sal3 they got negative signs as it was expected. From this and with sufficient statistical evidence we can state that erosion and salinity problems diminish the price of the rural lands.

Observing the group of variables Areah, Porcon and Porcana, only the first of this group showed negative sign whereas the other two showed positive signs. Porcana is the variable that draws attention because the cane is one of the main economic activities of the region.

The variables Piso1, Bufrcau, Dist_vía, Distk, Calvid3 showed coefficients with negative sign, which means: i) the lands that are in lower levels have a greater value, ii) the proximity to the River increase the value of rural lands, iii) have routes close, specially in good condition is a very important factor for increasing the value of the lands, iv) more proximity to the city of Palmira gives a special premium to the lands, possibly for the facility of products commercialization, and, v) the lands that are closer to low quality zones diminishes its value. On the other hand, it is important to indicate that the Palmi and Prof variables were not significant.

4. CONCLUSIONS

Pollution by particles represents a negative externality, which generates a loss of welfare in society. The importance of Carrizo's investigation is the fact that the losses in welfare can be quantified in monetary units, in order to formulate public policies that diminish this externality. Of course, if the social benefits to implement some corrective measurement are greater than their costs.
The implementation of a policy of pollution reduction brings about important benefits for the consumers of housings as well as for the local authorities. The benefits of a reduction policy estimated by Carriazo could be of at least USS 30´703.387.

The presence of urban parks in Bogotá influences in a positive way Bogotá's society because they are perceived as positive externalities, since they increase the value of housing in those sectors. The study estimates that people from Bogotá are willing to pay $15'155.500[4] to live near parks, in average close to 200 meters. Quantifying of this form, the started Penagos hypothesis.

The fortification of the public space and in particular a policy of zonal parks dedicated to the active recreation must be one of the priorities of people in charge of the public administration. Additionally, the mechanisms of citizen participation that are necessary to develop and implement this kind of initiatives must be created. A park's policy has a strong impact on the urban development and on the economic growth of the cities. As it was proven with the Penagos study, parks increase the value of housings, in other words they create greater wealth in his owners.

With respect to the research elaborated by Goyeneche, like the two works showed previously, its importance is give the quantitative evidence (monetary) of losses of welfare on individuals. In this case by cause of erosion, using for it the consumption of a private good like the property and based on hedonic models.
The results of this study serve on the one hand, to the private sector since on it they count on the information necessary to advance programs for the control of the erosion, on the other hand, to the organizations of public sector that they require of this type of studies to elaborate political of management and planning of the territory.

[4] US$ 1 = $ 2.800 Colombian pesos.

The cadastral information and the modern Land Information Systems developed by the cadastral authorities in Colombia must serve the academic community constructs development models as well as local and national authorities use them for the formulation of environmental and social policies.
Spatial Econometrics is contributing to tests and spatial models every time with greater capacity of prediction and would be important that the cadastral authorities modernize their methodologies and train their human resource in these areas of the knowledge. Of course, starting for the premise it is not possible to make this type of exercises without forming multidisciplinary groups of researchers.
Finally, it is important study the economic valuation, especially of nonmarketable goods (environmental goods) because only of this form the public administration can calculate the social's profits or costs that the implementation of any public policy and estimate the impact that this can have in the welfare of society.

REFERENCES

Borrero, S. 1999. The Economic and Social Justificaction for Cadastral Reform: The Latin American Expirience. UN-FIG Conference on Land Tenure and Cadastral Infraestructures for Sustainable Development, Melbourne, Australia.

Carriazo, F. 2000. Impactos de la Contaminación del Aire en el Precio de la Vivienda: una Valoración Económica. Facultad de Economía. Universidad de los Andes. Bogotá Colombia.

Castellanos, R. 2001. Apuntaciones Conceptuales y Metodológicas Sobre Avalúos de Bienes Inmuebles. Universidad Distrital. Bogotá, Colombia.

Goyeneche, F. 2003. Efecto de la Erosión en el Precio de la Tierra y sus Implicaciones de Política: Caso de la Cuenca Amaime-Nima-El Cerrito en el Valle del Cauca, Colombia. Facultad de Economía. Universidad de los Andes. Bogotá Colombia.

Martínez, Y. 2003. La Tenencia de la Tierra en Colombia. Instituto Geográfico Agustín Codazzi. Bogotá, Colombia.

Penagos, A. 2002. ¿Están los Bogotanos Interesados en Vivir Cerca de un Parque Urbano?. Facultad de Economía. Universidad de los Andes. Bogotá, Colombia.

Pinzón, J. 2002. El Impuesto Predial Unificado – IPU y el Catastro. 2001. Documento de Trabajo, Departamento Nacional de Planeación. Bogotá, Colombia.

Ratia, J. 2002. El Catastro al Servicio de la Protección del Medio Ambiente. Catastro. Madrid, España.

CONTACTS

Jose Antonio Pinzón Bermúdez.
Universidad de Barcelona
Canigo 96 Esc. A 2-4. (08031).
Barcelona
SPAIN
Tel. + 34 600362185 – + 34 934287120
Email:jpinzon@ub.edu; ja_pinzon@hotmail.com