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

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Localization

Easy access to all markets

Mid point between North and South America

Geographic and environmental diversity

Localization

Basic Information

Area:	1.141.748 km^2
Population:	42.321.361
Currency:	Peso
Capital:	Bogotá
Official Languages:	Castellan
Departments:	32
Municipals:	1.094
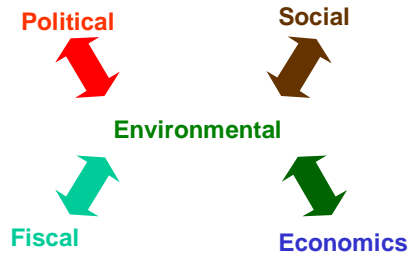
Formulation Policies

Political

Social

Environmental
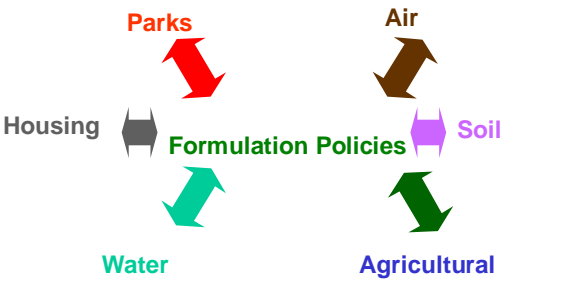
Fiscal

Economics

Environmental Policies

Parks

Air

Housing

Formulation Policies

Soil

Water
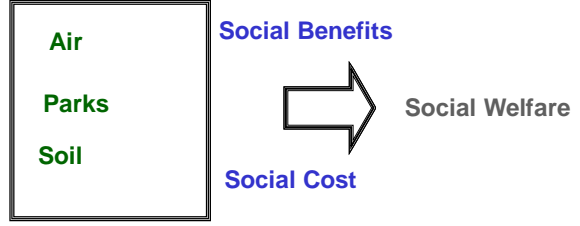
Agricultural

Environmental Policies

Air

Parks

Soil

Social Benefits

Social Cost

Social Welfare

Why Appraisal?

Consumers

Firms

⇒

- Consumption
- Health Human
- Parks
- Soil
- Air
- Housing
- Natural Resources
- Environmental
- Productivity
- Production

⇒ Externalities

⇩

PAY

How Appraisal?

Different methods

Direct methods:

- Contingent Valuation

Indirect methods:

- Travel Cost
- Household Function
- Avoid Cost
- Health Function,
- Hedonic Prices

Method Price Hedonics

- The basic premise is that the price of a marketable good is related to its characteristics or with the services that it provides

- By the intrinsic characteristics generally it is applied to the housing market

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Value of Housing (Neighbourhood)

(+) Near to:

- Beautiful Parks
- Safe Neighbourhood
- Beautiful Landscapes
- Good routes of access
- Schools
- Markets

(-) Near to:

- Landfills
- Industrial areas
- Pollution air
- Bad smell
- Unsafe Neighbourhood
- Noisy Neighbourhood

Value of Housing (Neighbourhood)

PROPERTY LEVEL

SUB-STREET LEVEL

STREET LEVEL

HGS AREA LEVEL

COMMUNITY LEVEL

Formulation Model

$$Z = (z_1, z_2, z_3, ..., z_n)$$ Structural Characteristics

Where Zi: building area, land area, construction materials, bedrooms, etc

$$A = (a_1, a_2, a_3, ..., a_n)$$ Neighbourhood Attributes

Where Ai: parks, shopping centers, safe, environmental characteristics, etc

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

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Principles Microeconomics (Consumers)

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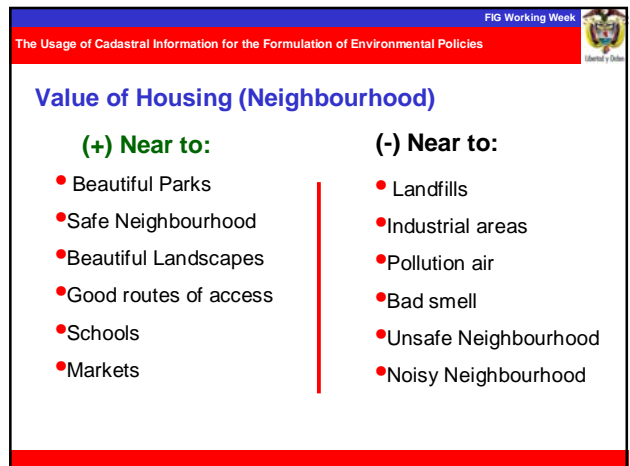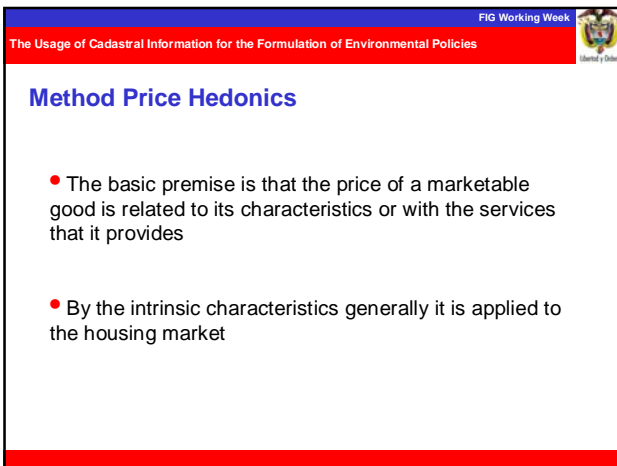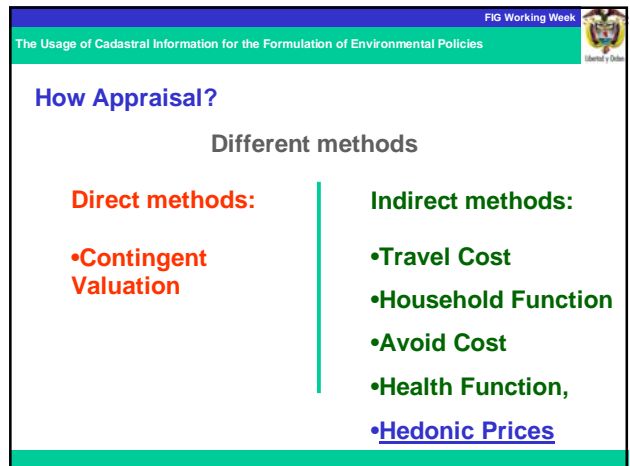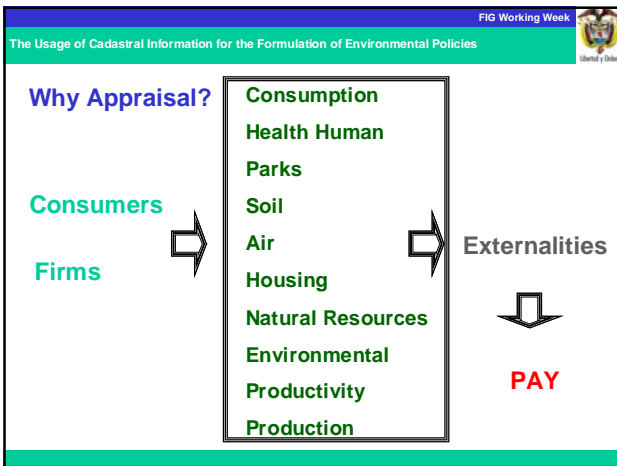
$$\text{s.t.} \quad P(Z,A) + X = Y$$

Solving

$$\phi(Z,A,Y,U;\alpha) \quad \text{W.T.P.}$$

Where: Z Structural characteristics, A surrounding attributes, Y home income level, X represent consumption of other goods and services, α socioeconomic characteristics.

Principles Microeconomics (Firms)

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

Solving $\quad \rho(Z,A,N;\beta) \quad$ W.T.A.

Where: $C(Z,A,N;\beta)$ Producer's cost function, N is quantity of produced units, β technology and price factors.

Principles Microeconomics (Firms and Consumers)

Colombian Cadastre in Numbers

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-DDPRE. *Established Land

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Case Study
Methodology

i) the sample was calculated and chose in a random way

ii) inconsistent data were eliminated

iii) tests of statistical validation were elaborated

iv) using GIS to evaluate the consistency of the sample from the point of view of space

v) econometric models were constructed and,

vi) analysis of results was done

Distribution Random Sample

Case of Atmospheric Pollution
Hypothesis

- 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

- To prove this hypothesis and to estimate loses of welfare of society; we need several sources of information, primarily on cadastral information

Case of Atmospheric Pollution
Model Econometric

Estimated econometric model using Box-Cox transformation

$$Avaluo^{(\theta)} = \beta_0 + \beta_1 punt^{(\lambda)} + \beta_2 arte^{(\lambda)} + \beta_3 arco^{(\lambda)} + \beta_4 uso^{(\lambda)} + \beta_5 via^{(\lambda)} + \beta_6 dust^{(\lambda)} + \beta_7 agua^{(\lambda)} + \beta_8 parc^{(\lambda)} + \beta_9 estr^{(\lambda)} + \varepsilon_i$$

Case of Parks
Hypothesis

- Maintain and conserve park and public spaces has a positive impact on the welfare of society.

- Parks and spaces public near increasing to value of housing.

- To prove this hypothesis and to estimate benefits of welfare of society; we need several sources of information, primarily on cadastral information.

Case of Parks
Model Econometric

Estimated econometric model using Box-Cox transformation

$$Avaluo^{(\theta)} = \beta_0 + \beta_1 Ac^{(\lambda)} + \beta_2 Capto^{(\lambda)} + \beta_3 Th^{(\lambda)} + \beta_4 Npl^{(\lambda)} + \beta_5 Es3^{(\lambda)} + \beta_6 Es4^{(\lambda)} + \beta_7 Es5^{(\lambda)} + \beta_8 Es6^{(\lambda)} + \beta_9 Norte^{(\lambda)} + \beta_{10} Tip3^{(\lambda)} + \varepsilon_i$$

Case of Parks

Case of Soil Erosion
Hypothesis

- Inadequate use of soil promotes an increment in erosion rates. So has a negative impact on the welfare of society

- Erosion of soil decreasing to value of land

- To prove this hypothesis and to estimate losses of welfare of society; we need several sources of information, primarily on cadastral information

Case of Soil Erosion
Model Econometric

Estimated econometric model using autoregressive models SAR

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

$$W_P = W * P$$

Where W is a matrix of weights constructed the inverse value of the distance between the centroids of lands
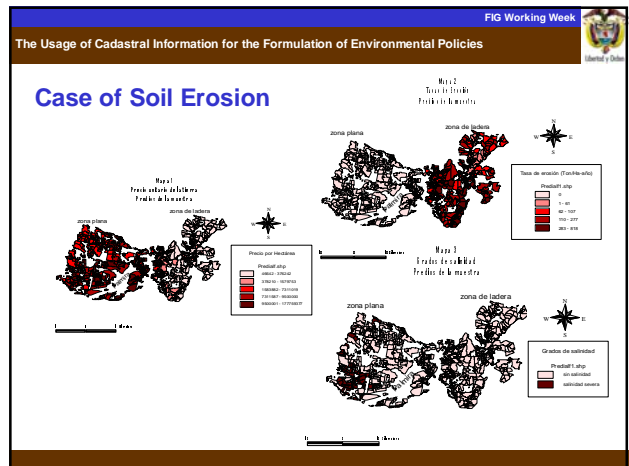

Case of Soil Erosion

Case Conclusions

- Pollution by particles represents a negative externality, which generates a loss of welfare in society. The importance is that the losses in welfare can be quantified in monetary units.

- 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.

- The importance is give the quantitative evidence (monetary) of losses of welfare on individuals. In the last case by cause of erosion, using for it the consumption of a private good like the property and based on hedonic models.

General Conclusions

- 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

- 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.

Thank you

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