



Estimation of the Number of Rights on Properties at the Community, Regional and National Levels, in Greece and their Use in Planning and Decision-making for the Development of the Hellenic Cadastre

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"Forecasting is risky, especially when it has to do with the future."
Joel Horowitz



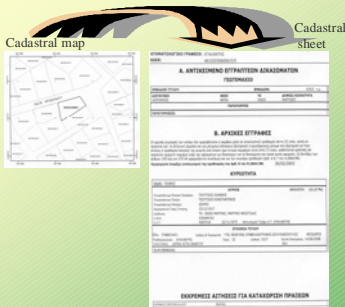
Overview

- ◆ Background
- ◆ The problem
- ◆ Data available
- ◆ Approach to solve the problem
- ◆ Specification of the model (calibration, internal validity, external validity)
- ◆ Use of the model to estimate the number of rights in Greece
- ◆ Use of the model in planning and decision making
- ◆ Conclusions

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Background The Hellenic Cadastre



- ◆ The mission of the Hellenic Cadastre is to develop a general, uniform, systematic and always updated registration of land properties in Greece and the rights that exist on them.
- ◆ This information would be guaranteed by the Greek State.
- ◆ In addition, the Hellenic Cadastre would serve as a source of valuable information that is necessary for the developmental activities of the country.



Background Cadastral surveying projects



- ◆ Programs
 - Pilot A'
 - Start 1995
 - Municipalities: 66
 - Pilot B'
 - Start 1997
 - Municipalities: 54
 - 1st Main
 - Start 1998
 - Municipalities: 221
- ◆ Expected completion 2004/2005
- ◆ Aggregate statistics
 - Number of municipalities: 341 (6%)
 - Total area covered: 8.400 Km² (6%)
 - Number of rights: 5.800.000 (17%)
 - Transitional cadastral offices: 97 (24%)

Legend
 ■ Pilot A' area
 ■ Pilot B' area
 ■ 1st Main area



Background Data collection and validation procedure



- ◆ Compilation of base maps
- ◆ Collection of declarations and data processing
- ◆ Data validation
 - 1st Publication
 - 2nd Publication
- ◆ 1st Registrations

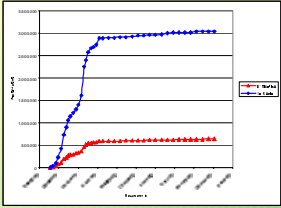


The Problem



- ◆ Estimate the number of property rights in each municipality in Greece.
- ◆ Rights collected
 - Freehold
 - Mortgage
 - Seizures
 - Servitudes
 - Leaseholds
 - ...
- ◆ Municipalities in Greece: 5,775
- ◆ Importance to solve the problem:
 - The number of rights is the most important cost driver of the cadastral surveying procedure.

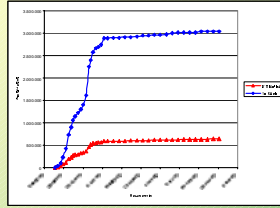
Data available



- ◆ 1991 Census data at the municipal level
 - Number of dwellings
 - Number of agricultural parcels
 - Urban area
 - Rural area
 - Grassland area
 - Forest area
 - ...
- ◆ Number of rights registered at "1st Publication" for each municipality in the first three Programs
- ◆ Monthly rates of registrations of rights in each municipality in the projects

"When you have the right problem you have the wrong data, and when you have the right data you have the wrong problem." Murphy's Law on data


Approach to solve the problem



- ◆ Three stage approach
 - Specify a model that estimates the number of rights at the time of "1st Publication"
 - Estimate the rate of change of the number of rights after the "1st Publication"
 - Compute the number of rights at "1st Registration"

Specification of the model

Multivariate Regression Analysis



- ◆ Regression model (calibrated on the data of the 1st Main Program)

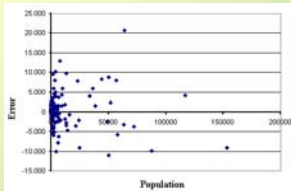
$$N_{Rights} = 2,01 \cdot R + 2,31 \cdot D + 1,26 \cdot U + 0,08 \cdot G - 2,44 \cdot O$$

- R: Number of rural parcels
- D: Number of dwellings
- U: Urban area (in 1000's of sq. meters)
- G: Grassland area (in 1000's of sq. meters)
- O: Number of business operations using agricultural land

R²: 0,98
 Standard Error: 3,317
 Number of observations: 217
 F-statistic(5, 212): 1922 (Significance: 8E-174)

Specification of the model

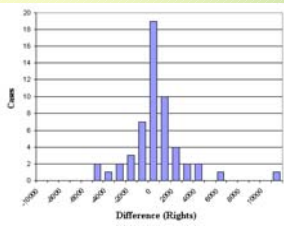
Internal validity checks



- ◆ Multicollinearity
- ◆ Heteroskedasticity
- ◆ Correctness of model specification
- ◆ Spatial aggregation
- ◆ Autocorrelation


Specification of the model

External validity checks



- ◆ Check against Pilot A' Data
 - Deviation on 7% at the Program Level
- ◆ Check against Pilot B' Data
 - Deviation on 1% at the Program Level

Estimation of the number of rights at the stage of "1st Publication"



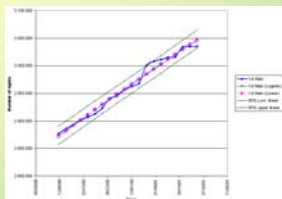
- ◆ Total number of rights for the country
 - $N_{Rights} = 29.400.000$
 - Standard error = $\pm 1.000.000$ ($\pm 3\%$)
 - Confidence interval (95%) [27.450.000 – 31.350.000]
 - Confidence interval (99%) [26.800.000 – 32.000.000]

Legend (Rights/km²)

- 200 - 300
- 300 - 400
- 400 - 500
- 500 - 1500
- 1500 - 20000



Estimation of the rate of change of the number of rights after the "1st Publication"



◆ Use trend analysis to determine the rate of change

$$R_m = 8,750 \text{ (rights/month)}$$

◆ Estimation of the coefficient for converting the number of rights at "1st Publication" into number of rights at "1st Registration"

$$a = 1,12 \pm 0,01$$

(an expected 12% increase in the number of rights)

◆ Estimation of the total number of rights at "1st Registration"

$$N_{\text{Rights_at Reg.}} = 1,12 * N_{\text{Rights_at Pub.}}$$



Estimation of the number of rights at the stage of "1st Registration"



Legend (Rights/km²)



◆ Total number of rights for the country

$$N_{\text{Rights}} = 32,900,000$$

$$\text{Standard error} = \pm 1,150,000 (\pm 3,5\%)$$

$$\text{A "2-sigma" confidence interval: } [30,600,000 - 35,200,000]$$



Use of the model in planning and decision-making



Legend (Rights/km²)



◆ Estimate cost of the project

◆ Determine number of rights in urban and rural areas

◆ Incorporate uncertainty in costing and planning

◆ Delineate contract areas

◆ Develop scenarios about various project planning choices



Conclusions

◆ A model was presented for estimating the number of rights in Greece at various geographical aggregation levels (municipal, regional, national).

◆ The model has been validated internally and externally and used to estimate the number of property rights in Greece.

◆ The expected number of rights is $32,900,000 \pm 1,150,000$.

◆ The "goodness of fit" of the model, as well as, its accuracy are satisfactory ($R^2 = 0,98$, Accuracy $\approx \pm 3,5\%$).

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