APPLICATION OF ECONOMETRIC MODELS TO ESTIMATE THE FARMLAND VALUE IN SPAIN BY AUTONOMOUS COMMUNITIES.

Guadalajara Olmeda, Natividad
Fenollosa Ribera, Mª Loreto
Ribal Sanchis, Francisco Javier
Centro de Ingeniería Económica.
Escuela Técnica Superior de Ingenieros
Universidad Politécnica de Valencia
Camino de Vera s/n
46071 Valencia.
Teléf.: 963 879 032.
e-mail: nguadala@omp.upv.es

SUMMARY

In the present paper the possibility of applying econometric models to estimate the farmland value by autonomous communities in Spain is analysed.

We have started from two different sources of farmland prices. The first on comes from the yearly survey of farmland prices realized by the Ministry of Agriculture in Spain. It comprises prices of the farmland classified by autonomous communities and crops. The second one are constituted by the sample prices of an appraisal company.

In both cases we estimate a model which is function of two factors : the first one is related with the crop, the second one with the localization of the region.

The factor related with the crop is defined by vegetable gross output in the sample prices model and by the holding of water and the difference between woody and field crops in the official prices. Likewise the localization in the official prices is determinated by the rainfall, the presence of sea coast in the region and the amount of farms.

The official prices and the sample prices of the appraisal company are contrasted with the objective of analysing the differences between both sources.

Factorial analysis technique is used to obtain the main variables that constitute the localization factor. Then the ordinary least squares technique is used to quantify the coefficients of the variables that influence in the farmland price.

KEY WORDS : valuation, farmland, ecometric models.

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1. BACKGROUND.

The estimate of the value of the farmland by means of econometric models is been broadly treated in the economic literature. Nevertheless, in the valuation practice, it is difficult to estimate the market value, this is due, mainly, to the lack of information about transactions of properties. Furthermore the absence of transparency, the heterogeneity of farmland raises a special problem in its valuation. This way, Caballer (1998), Martínez (1996) and García (2000) indicate that several factors influence and, sometimes, distort the knowledge of the farmland value in a certain area.

In the last years, serious studies have been carrying out in Spain using econometric models to estimate market farmland values.

This way, in 1994, Sabaté, studied the price of fruit trees land, no citrics, in Cataluña in order to contrast the values of this asset in the R.E.C.A.N. (National Agrarian Countable Net). In that work a grouping of villages was carried out and, from data surveys, they obtained as coefficients of the model the average prices for each grouping.

But where more works have been carried out in this line, it has been under the direction of the Centro de Ingeniería Económica de la Universidad Politécnica de Valencia. Specifically, Martínez (1996) achieves an analogical model of valuation to obtain the market value of farmland in the region of La Rioja in the year 1995. From a sample composed by 822 data of results of transactions of farmland in the free market he obtained a econometric model in function of the crop, irrigation posibility, distance, expectations of use, type of access, soil quality, structural improvements and possibility of annexation, with a coefficient of determination of 63%.

Also, García (2000), from information of 320 smallholdings, located in the municipalities of Lerín and Viana in the region of Navarra, ended up obtaining a estimate model of the market value for the year 1996. In this model, with a coefficient of determination of 82%, the market value depends on the variables soil, access, forms and cultivation.

Finally, the study by Fenollosa (1999) in the county of Valencia, for the period from 1983 to 1996. Starting from the municipal terms data used as base in the elaboration of the survey of farmland prices by the Ministry od Agriculture. In that work the minimum market value is obtained, with a coefficient of determination of 76%, in function of the crop, distances to the sea, the ratio “masculine agrarian populatio/area of the municipal term” and total investment in energy in each municipal term.

All the previous works have in common the study of the market of farmland from a regional, provincial or municipal point of view, and they are relatively abundant in Spain. The studies from a macrospatial optics, on the contrary, are many more scarce than the previous ones and they lean on the existence of a national market of farmland, this will constitute our starting hypothesis to obtain some econometric models for explaining the value of the farmland. Nevertheless, since the data, and therefore the built models are referred to autonomous communities, and they do not descend at the level of counties and municipalities, it is assumed that some explanatory variables as localization in the municipal term, microclimate, forms, access, etc.., are identical in all the parcels in every region, and they do not influence in the value.

Figure nº 1. Map of Spain.

2. DATA SOURCES

For the realization of this work two main sources of farmland values have been used. The first one is composed by the results of the yearly survey of farmland prices in Spain, published by the Ministry of Agriculture, and they might be considered as official prices of farmland in Spain. The second one contains the sample prices that uses one of the first companies of real state appraisal registered in the Bank of Spain to this purpose.

The first source picks up the prices of the hectare of farmland, for each autonomous region and crop, from 1983 to 1999, see figure nº 1. Seven crops are considered in this source : dry farming, irrigated land, nuts and dried fruits trees, citric, vineyard in unirrigated land, olive grove in unirrigated land and natural grasslands in unirrigated land. The amount of available farmland values is 381(number of rows of the matrix), since not every crops are cultivated in every communities.

The second source of information is a data base formed by 3.183 data from the year 1998. Those data are referred to farmland properties distributed in the national territory, in monoculture. It means that in each parcel of the data there is a single kind of fruit tree, or, that there is not mixture of woody and herbaceous or horticultural crops.

In this data base, the available information for each parcel are composed by the sample prices : informations of real transactions or supply prices, all of them obtained by the appraisers of the company.

Also, for each one of these 3.183 data there is information about the kind of crop, area of the property, the possibility of watering and the municipal term to which belongs.

Those cases with unitary values distant from the media of each group in ±2 standard deviations have been removed. This has counted a total of 316 cases.

With the purpose of comparing the farmland value of both databases, the arithmetic means of the sample prices for each region and crop have been obtained.

Since in both sources, it is only known the crop and the region -data that can be used as possible explanatory variables of the price- both databases have been supplemented with more complementary information. This way, some data have been picked up of the National Farm Accountacy Network (RECAN), especifically, these explanatory variables : “Vegetable gross output/Total utilised agricultural area”, “Family farm income” and “farm subsidies”, from 1990 to 1998 (last published year).

The observation field of the RECAN includes those Spanish farms with an economic dimension of, at least, 2 ESU (European Size Unit). Regarding the total population of farms it comprises the 36,6% of the number of farms and it represents 90,5% of the standard gross margin over the national standard gross margin.

The variable "Vegetable gross output/Total utilised agricultural area" is quantified in thousands of pesetas for hectare. The first component, the vegetable gross output or vegetable total production includes the vegetable products reutilized in the farm. The work is referred to farms dedicated exclusively to vegetable crops (no cattle) for what the concept of reutilization is not relevant. The second component is the "Total utilised agricultural area" which meaning is clear.

In the variable farm subsidies the compensatory payments in field crops have been included.

The RECAN uses a typology of farms that is not completely coincident with the data provided by the yearly survey of farmland prices in Spain published by the Ministry of Agriculture. For that reason it has been necessary to carry out a work of filtrate, calculation and weighing of the orientations of the RECAN to adapt them to the typology of the survey of famland prices.

The RECAN data are classified in several intervals according to the ESU of the farm. We have worked with the total data (they include all the interviewed farms)

The adaptation between sources is, schematically, as follows :

?? Dry farming : cereals in unirrigated land ; roots and tubers in unirrigated land ; cereals, roots and tubers in unirrigated land ; oleaginous and textile crops in unirrigated land.

?? Irrigated land: cereals in irrigated land ; roots and tubers in irrigable land ; cereals, roots and tubers in irrigable land ; oleaginous and textile crops in irrigable lands ; horticulture.

?? Vineyard: D.O. viticulture and another viticulture.

?? Olive grove : oliviculture

In those cases that a tipology of the survey of farmland prices includes several orientations RECAN, we have calculated the weighted average, weighing with the area of each orientation.

The RECAN series began to differ among farms of unirrigated land and irrigated land in the year 1994. Therefore, the data of unirrigated and irrigated land previous to that year, especially in the cases of Castilla-León, Castilla-La Mancha, Aragón, Andalucía and Extremadura, have been calculated from the data of the RECAN, according with the ratio between of gross outputs of irrigated and unirrigated crops of the year 1994.

Other complementary sources, sources of macroeconomic character at level of autonomous communities, have been used. Mainly, the Municipal Census and data from the the National Institute of Statistics.

From the group of the consulted sources, the following explanatory variables were obtained, all them referred to the year 1998 (although some of them were picked up in other years, mainly for the year 1997) and at level of autonomous communities, which are related hereinafter:

a) Variables of population and conditions of life.

The used variables are: Population for provinces and population for capitals; number of childrens for woman; migrations for destination region and for origin region (data for 1997), emigrations, immigrations and migratory balance for autonomous communities (data for 1997). Also we have used variables as rate of unemployment, licences of work, wages, average gainings for worker and month for each professional category, and the index of inflation.

b) Agricultural Variables.

In this group we have considered the following variables: total area and used agricultural area of the farms; general distribution of the area (for the whole lands, ploughed lands, lands for permanent grasses, other lands and total utilised agricultural area); use of the lands (ploughed lands, dry ploughed lands, irrigates ploughed lands and not ploughed); cattle raising (bovine, sheep, goat, porcine, … and average area per farm.

Variables are included referred to help: areas desfavorecidas that perceive the compensatory damages in 1998, basic compensatory damages, payments made in 1998 and investments of the Ministry of Agriculture in rural infrastructure for 1998.

c) Physical variables.

- Area: in Km2..
- Average temperature, in ºC.
- Average humidity, in percentages.
- Total precipitations, in millimetres (average for a 25 years period)
- Existence of sea coast in the autonomous community (0/1)
- Localization: *localization* was obtained from a map of Spain in which a x-axis and a y-axis were created. After this, the centre of gravity for each region was roughly estimated. So, we divided Spain in communities that were northern or southern and eastern or western.

d) Variables from other sectors.

Building of housing per region for the year 1998, are comprised in variables such: VPO (state subsidized housing) plus free housing, VPO (general and special), VPO of public promotion, free housings and approved projects for VPO and for free housings. Number of hotels.

e) Other variables.

Other variables have been picked up for each region as: first-time registered properties and real estate sales (1997), number of mortgages (1998). Registered sinisters (number of sinisters declared to the agrarian insurance companies, hectares affected by these sinisters in 1998). Number of agricultural cooperatives and the number of farmers that belonged to an agricultural cooperative.

In the official farmland prices explanation model other variables have also been used like the rate of interest in mortgage, the interior public debt, the index of prices for autonomous communities and for the whole country.

3. METHODOLOGY.

The applied methodology ordinary least square regression analysis. In this analysis the market value of an asset, Vm, it is considered that is related with a group of characteristics or explanatory variables (x1,x2... xn), according to an expression as:

$$Vm=f(x1,x2... xn)$$

The previous expression is calculated from the database made up by farmland prices of transactions already done and the specific features of the properties.

In the models of valuation of farmland, the endogenous variable Vm will be the price of the farmland. The explanatory variables (x1,x2... xn) will be given by the study of correlations and by a factorial analysis, so that, from the initial whole group of explanatory variables those with more influence in the value and not correlated will be choosen.

To do that, we have studied, in the first place, the correlation coefficients of every independent variables with the dependent one, and we have selected those more correlated. Later on a factorial analysis with the selected variables has been carried out to gather these in factors according to their correlation and, finally the analysis of regression tooked placed choosing a single variable of each factor. Then the analysis was repeated for each one of the possible combinations of variables included in each factor. This way the best model to estimate the farmland market value, will be the the regression analysis with better statistics.

The statistical software used in the whole process was the SPSS 2000.

4. INTERPRETATION OF THE OFFICIAL PRICES OF THE FARMLAND.

From the data of the farmland prices survey by autonomous communities carried out by the Agriculture Ministry we are able to obtain a model of valuation that explains the formation of the official prices of farmland in Spain.

Two models have been obtained, one for dry farming and irrigated land (without woody cultures) land, and the other one for the total kind of crops.

a) Model for farmland (field crops)

For the period from 1983 to 1999, a model of valuation using as explanatory variables: the holding of water, the time and the localization of the autonomous communities. Since the source of data does not differentiate the kind of crop into the field crops, it is supposed that the rent of the land is the same for all the field crops, and therefore, the kind of crops does not influence in the price of the land.

Starting from this hypothesis, it is tried to obtain the following mathematical model, by means of ordinary least squares analysis:

$$P = a + b\,A + c\,T + dj\,Lj$$

where

P = price of the farmland, in thousands of pesetas per hectare, deflated to 1983 with the index of prices of the farmland.

A = holding of water, it takes 1 for irrigated land and 0 for dry land.

T = time, it takes 1 for the year 1983, up to 17 for the year 1999.

Lj = region, it takes 1 if is refered to the region j and 0 if it is refered to any other.

It has been used the prices deflated to the year 1983 to achieve a greater explanation of the model (bigger coefficient of determination). The estimate of the value in monetary terms drives to an equation in which the chronological variable is not significant. On the contrary, the consideration of the deflated values improve the statistics and the variable time (as defined) is a significant explanatory variable.

So we have built a matrix formed by 442 rows (13 communities, 2 types of farmland earth -irrigated and unirrigated land- and 17 years) and 15 columns (one for the variable holding of water, another for the variable time and 13 dummy variables to define the different communities).

If the 13 dummy variables (Lj) are zero, the value provided by the model will be refered to the region of Castilla-La Mancha. The results of the analysis are shown in table nº 1.

Table nº 1. Model for farmland (field crops)

Resumen del modelo

Modelo	R	R cuadrado	R cuadrado corregida	Error típ. de la estimación
1	,920[a]	,847	,842	206,68

a. Variables predictoras: (Constante), Andalucía, AGUA, TIEMPO, MURCIA, VALENCIA, MADRID, CASTLEON, BALEARES, CATALUÑA, ARAGÓN, LARIOJA, NAVARRA, GALICIA

Coeficientes[a]

Modelo		Coeficientes no estandarizados		Coeficientes estandarizados	t	Sig.
		B	Error típ.	Beta		
1	(Constante)	122,570	32,420		3,781	,000
	TIEMPO	-15,116	2,007	-,143	-7,533	,000
	AGUA	743,392	19,662	,716	37,809	,000
	GALICIA	1018,390	43,412	,522	23,459	,000
	NAVARRA	472,085	43,412	,242	10,874	,000
	LARIOJA	521,381	43,412	,267	12,010	,000
	ARAGÓN	121,798	43,412	,062	2,806	,005
	CATALUÑA	274,168	43,412	,141	6,315	,000
	BALEARES	733,340	43,412	,376	16,893	,000
	CASTLEON	74,758	43,412	,038	1,722	,086
	MADRID	259,080	43,412	,133	5,968	,000
	VALENCIA	548,610	43,412	,281	12,637	,000
	MURCIA	238,667	43,412	,122	5,498	,000
	Andalucía	525,349	43,412	,269	12,101	,000

a. Variable dependiente: Tierra deflactada

So the model is the following one:

P = 122´57 + 743,4 A - 15,12 T + 1018,4 Galicia + 733,34 Baleares + 548,6 Valencia + 525,34 Andalucía + 521,4 LaRioja + 472 Navarra + 274,17 Cataluña + 259 Madrid + 238,7 Murcia + 121,8 Aragón + 74,8 CasLeon (#1)

As you see, a fairly high adjusted coefficient of correlation is obtained, 0,842, what indicates the kindness of the adjustment. The rest of the variability, up to 1, would possibly explained by the rent of the different field crops and the specific characteristics of each parcel such microclima, localization inside the municipal term, access to the parcel, etc.

If instead of deflating the farmland values with the index of prices of the farmland, we would have choosen the general index of prices the obtained result would be a similar model, with slight differences in the coefficients and with the only exception that the region of Castilla-León would not be in the equation. That would mean that there is non-significant differences with the region of Castilla-La Mancha.

The interpretation of the previous model is the following one:

1º The independent term 122,57 indicate that if all the exogenous variables take the zero value, the probable market value is of 122.570 pesetas per hectare. This is, the unirrigated land of the region of Castilla-La Mancha, in the year 1983, had a value of 122.570 pts/ha.

2º The value of irrigated land, in Spain, increases the value of unirrigated land in 743.392 pesetas per hectare.

3º The value of the farmland (field crops) has diminished, in real terms, in the period 1983-1999 to reason of 15.120 pesetas per hectare and year as average term in the whole national territory. In monetary terms the value of the land does not follow any upward or downward tendency in the time.

4º The coefficient corresponding to each one of the communities indicates the increment of the value of the farmland (for field crops) in comparison with the region of Castilla-La Mancha (all the dummy variables as zero). This way, the crop field land in the region of Galicia is worth 1.018.390 pesetas per hectare more than in region of Castilla-La Mancha. Galicia would be the community with the field crops land greater value, followed by Baleares and the community of Valencia. In the opposite side Castilla-León is located as the community with an average value that is only 74.758 pesetas per hectare more expensive than Castilla-La Mancha field crops land value.

5º The fact that all the communities have positive coefficients means that the region without dummy variable has a fewer value of the farmland, as it is said Castilla-La Mancha.

6º The community of Extremadura is not in the final model since its coefficient does not come out statistically significant. This means that significant differences do not exist between the value of the farmland for field crops in the region of Extremadura and the region of Castilla-La Mancha.

b) Model for every kind of crops:

The previous study has also been carried out for the group of all the considered crops and for the period from 1990 to 1998. In this case a shorter temporary series has been taken, with the purpose of comparing the results with the obtained ones in the following part of the paper, in which the price is explained combining other sources of data, mainly with the RECAN.

We were trying to obtain a similar model to the previous one also considering a woody variable that takes the value 0 in field crops and 1 in fruit tree cultures. In this case, the prices have also been deflated to the year 1990, using the index of prices of farmland and taking as reference the community of Aragon (all dummy variables equal to zero). The observations of citrics in the region of Valencia for the years 1990, 1997 and 1998 have been eliminated of the analysis (outliers). The results have been the following ones, see table nº 2.

Table nº 2. Model for every kind of crops

Resumen del modelo

Modelo	R	R cuadrado[a]	R cuadrado corregida	Error típ. de la estimación
1	,930[b]	,866	,861	514,18

a. Para la regresión a través del origen (el modelo sin término de intersección), R cuadrado mide la proporción de la variabilidad de la variable dependiente explicado por la regresión a través del origen. NO SE PUEDE comparar lo anterior con la R cuadrado para los modelos que incluyen una intersección.

b. Variables predictoras: Cantabria, País Vasco, Andalucía, VALENCIA, BALEARES, CATALUÑA, LARIOJA, NAVARRA, GALICIA, ASTURIAS, AGUA, Herb:0, Leñ: 1

ANOVA[c,d]

Modelo		Suma de cuadrados	gl	Media cuadrática	F	Sig.
1	Regresión	628119466	12	52343289	197,986	,000[a]
	Residual	97555766	369	264378,770		
	Total	725675232[b]	381			

a. Variables predictoras: Cantabria, País Vasco, Andalucía, VALENCIA, BALEARES, CATALUÑA, LARIOJA, NAVARRA, GALICIA, ASTURIAS, AGUA, Herb:0, Leñ: 1

b. Esta suma de cuadrados total no se ha corregido para la constante porque la constante es cero para la regresión a través del origen.

c. Variable dependiente: Preciodeflac

d. Regresión lineal a través del origen

Coeficientes[a,b]

Modelo		Coeficientes no estandarizados B	Error típ.	Coeficientes estandarizados Beta	t	Sig.
1	Herb:0, Leñ: 1	568,629	47,901	,288	11,871	,000
	AGUA	1232,423	58,642	,467	21,016	,000
	GALICIA	2789,147	131,338	,414	21,236	,000
	NAVARRA	404,742	106,035	,075	3,817	,000
	LARIOJA	677,079	102,667	,131	6,595	,000
	CATALUÑA	155,562	94,545	,033	1,645	,101
	BALEARES	753,715	179,144	,084	4,207	,000
	VALENCIA	675,006	99,354	,150	6,794	,000
	Andalucía	517,128	84,695	,127	6,106	,000
	País Vasco	1593,660	177,961	,177	8,955	,000
	ASTURIAS	889,179	172,545	,099	5,153	,000
	Cantabria	987,236	172,462	,110	5,724	,000

a. Variable dependiente: Preciodeflac

b. Regresión lineal a través del origen

The constant does not come out significant and it has been removed from the model, so the real coefficient of correlation is 0,70, not the coefficient of determination of table nº 2.

The resulting model is:

P = 1.232,4 TO + 568,6 L +2.789 Galicia + 1.593,6 PaiVasco+ 987,2 Canta+ 889 Astur+ 753,7 Balearic + 677 LaRioja + 517 Andalusia + 675 Valencia + 404,7 Navarrese + 155,6 Catalonia (#2)

The interpretation of the model is the following one:

1º The value of the irrigation, in general term, elevates the price of the earth in 1.232.423 pesetas the hectare.

2º The lands with tree fruits cultures are worth in 568.629 pesetas per hectare more than the field crops lands. This differential value would correspond to the value of the trees.

3º The time does not turn out to be significant, that means that in constant terms the value of the farmland has not varied between the years 1990-1998.

4º The region with a lower price is Aragon, taken as reference. On the contrary, Galicia continues being the region where the price of the farmland is the highest followed of by the País Vasco, Cantabria and Asturias, this is, the north area of Spain.

5º The communities of Madrid, Castilla-León, Castilla-La Mancha, Extremadura and Murcia do not make up the model. This means that their price hardly differs of the community of Aragon price.

5. DETERMINATION OF THE EXPLANATORY VARIABLES THAT INFLUENCE IN THE OFFICIAL PRICE OF THE FARMLAND

In the previous section two models have been estimate for interpreting the construction of the prices by the official agencies. Nevertheless, it is interesting to analyze which variables are those that really cause and determine these differences in prices. It is tried to obtain a model that explains the official price of the farmland in function of the group of explanatory variables described in the section 1.

The results for the outstanding models are shown in tables nº 3 y nº 4

Table nº 3 Model with vegetable gross output variable

Resumen del modelo[d]

Modelo	R	R cuadrado	R cuadrado corregida	Error típ. de la estimación
1	,788[a]	,621	,606	,5045
2	,788[b]	,621	,609	,5027
3	,787[c]	,620	,611	,5012

a. Variables predictoras: (Constante), LNPFA, Herb:0, Leñ: 1, LNSUBVAC, LNRATIO, LNPLUVIO

b. Variables predictoras: (Constante), LNPFA, Herb:0, Leñ: 1, LNRATIO, LNPLUVIO

c. Variables predictoras: (Constante), LNPFA, LNRATIO, LNPLUVIO

d. Variable dependiente: LNPRECIO

Coeficientes[a]

Modelo		Coeficientes no estandarizados		Coeficientes estandarizados	t	Sig.
		B	Error típ.	Beta		
1	(Constante)	1,174	,432		2,717	,007
	Herb:0, Leñ: 1	-4,65E-02	,095	-,027	-,489	,626
	LNSUBVAC	-6,82E-03	,027	-,014	-,256	,798
	LNPLUVIO	,587	,064	,546	9,139	,000
	LNRATIO	,284	,055	,307	5,162	,000
	LNPFA	,545	,057	,529	9,487	,000
2	(Constante)	1,144	,414		2,762	,007
	Herb:0, Leñ: 1	-4,35E-02	,094	-,025	-,462	,645
	LNPLUVIO	,589	,063	,548	9,292	,000
	LNRATIO	,282	,054	,304	5,213	,000
	LNPFA	,544	,057	,529	9,517	,000
3	(Constante)	1,114	,408		2,731	,007
	LNPLUVIO	,591	,063	,549	9,349	,000
	LNRATIO	,281	,054	,303	5,213	,000
	LNPFA	,543	,057	,528	9,534	,000

a. Variable dependiente: LNPRECIO

Variables excluidas[c]

Modelo		Beta dentro	t	Sig.	Correlación parcial	Estadísticos de colinealidad
						Tolerancia
2	LNSUBVAC	-,014[a]	-,256	,798	-,022	,919
3	LNSUBVAC	-,011[b]	-,196	,845	-,017	,934
	Herb:0, Leñ: 1	-,025[b]	-,462	,645	-,040	,993

a. Variables predictoras en el modelo: (Constante), LNPFA, Herb:0, Leñ: 1, LNRATIO, LNPLUVIO

b. Variables predictoras en el modelo: (Constante), LNPFA, LNRATIO, LNPLUVIO

c. Variable dependiente: LNPRECIO

Table nº 4 Model without vegetable gross output variable

Resumen del modelo[c]

Modelo	R	R cuadrado	R cuadrado corregida	Error típ. de la estimación
1	,861[a]	,742	,732	,4164
2	,861[b]	,742	,734	,4148

a. Variables predictoras: (Constante), AGUA, LNRATIO, LNSUBVAC, LNPLUVIO, Herb:0, Leñ: 1

b. Variables predictoras: (Constante), AGUA, LNRATIO, LNPLUVIO, Herb:0, Leñ: 1

c. Variable dependiente: LNPRECIO

ANOVA[c]

Modelo		Suma de cuadrados	gl	Media cuadrática	F	Sig.
1	Regresión	65,201	5	13,040	75,219	,000[a]
	Residual	22,710	131	,173		
	Total	87,911	136			
2	Regresión	65,199	4	16,300	94,735	,000[b]
	Residual	22,712	132	,172		
	Total	87,911	136			

a. Variables predictoras: (Constante), AGUA, LNRATIO, LNSUBVAC, LNPLUVIO, Herb:0, Leñ: 1

b. Variables predictoras: (Constante), AGUA, LNRATIO, LNPLUVIO, Herb:0, Leñ: 1

c. Variable dependiente: LNPRECIO

Coeficientes[a]

Modelo		Coeficientes no estandarizados		Coeficientes estandarizados	t	Sig.
		B	Error típ.	Beta		
1	(Constante)	1,933	,319		6,066	,000
	Herb:0, Leñ: 1	,540	,088	,309	6,173	,000
	LNSUBVAC	1,789E-03	,022	,004	,081	,935
	LNPLUVIO	,843	,053	,784	15,852	,000
	LNRATIO	,274	,045	,296	6,055	,000
	AGUA	1,451	,104	,699	13,909	,000
2	(Constante)	1,941	,301		6,456	,000
	Herb:0, Leñ: 1	,540	,087	,308	6,230	,000
	LNPLUVIO	,843	,053	,783	16,047	,000
	LNRATIO	,275	,045	,297	6,178	,000
	AGUA	1,451	,104	,699	13,962	,000

a. Variable dependiente: LNPRECIO

Variables excluidas[b]

Modelo		Beta dentro	t	Sig.	Correlación parcial	Estadísticos de colinealidad Tolerancia
2	LNSUBVAC	,004[a]	,081	,935	,007	,919

a. Variables predictoras en el modelo: (Constante), AGUA, LNRATIO, LNPLUVIO, Herb:0, Leñ: 1

b. Variable dependiente: LNPRECIO

From the two models the last one is chosen because having some better statistics. The econometric models are expressed in the following way:

LnP = 1,114 + 0,543 LnPFA + 0,591 LnPluvi +0,281 LnRatio (#3)

LnP = 1'94 + 1,45 A + 0,53962 L + 0,84288 LnPluvi + 0,2749 LnRatio (#4)

Being:

Ln : natural logarithm
P = price of the farmland, in thousands of pesetas per hectare, deflated to the year 1990 with the index of prices of the farmland.
PFA = Vegetable gross output
L = Dummy variable that distinguish between woody cultures -1- and field crops -0-.
A = Holding of water, it takes the value 1 for irrigated farmland or 0 for unirrigates farmland.
Pluvi = average precipitations (average of 25 years). It is measured in mm
Ratio = existence of sea-coast x (number of farms of the region / average number of farms of the region). The existence of sea coast is 1 in communities with sea coast and 0 in the others.

As it can be seen from the first model the variables cumulated subsidies (SUBAC) and woody (herbaceous crops or fruit trees)(herb: 0 Leñ:1) has been removed. In the second model only the cumulated subsidies variable has been removed. In both models no outlier datum has been removed.

The interpretation of the equation is the following one:

1º No variable related with the output appears expressly, the opposite was expected . So the output would be represented in the choosen model (#4) by the variable L and A both with positive coefficients (as expected). Both variables were used to interpret the price in the previous model (#2)

2º Neither farm subsidies are explanatory variables in the official price of farmland.

3º The variables Pluvi and Ratio indicate the localization of the community, and they would be the substitutes of the variable communities that were in the previous model (#2). Their positive coefficients indicate that in the communities with more precipitations, the price of the farmland is bigger because the saving of water. The coefficient of the variable Ratio indicates us that the communities that have sea and a high number of farms have higuer prices than the interior ones and than those with a reduced number of farms.

4º The time neither appears as explanatory variable of the price, which ratifies that no appreciation of farmland has taken place in the nineties (1990-1998), according with the official sources.

6. ESTIMATE OF THE PRICE OF THE FARMLAND IN SPAIN FROM SAMPLE PRICES OF AN APPRAISAL COMPANY.

In this section we try to estimate the price of the farmland for the year 1998, using the sample prices of an appraisal company. From a database supplied for the appraisal company we have obtained the average prices for community and crop (38 data). Then we have built a matrix with 38 rows and 253 columns (possible explanatory variables). The result has been 11 variables correlated with the price, only contained in two non correlated factors:

?? Factor 1:

SA.LA.HA: Distribution of the agricultural area of ploughed lands, in hectares.
SAGR.S.P.: Percentage of utilised agricultural area of the farms.
SAGR.S.H.: Hectares of utilised agricultural area of the farms.
SAGR.T.H.: Total agricultural area, in hectares.
SAGR.T.P.: Total agricultural area in percentage over the total area for each autonomous region.
SUPF.TOT: Total area, in Km2.
ALA.HE.H: Field crops area, in hectares

?? Factor 2:

TEMP.MED.: Average temperature, in ºC.
N.HIJO.M: Number of childrens for woman for autonomous communities.
PB: Vegetable gross output, in pesetas per hectare.
IPC.VIVI:. Annual average of the index of prices in housing.

The choosen variables in the selected model were: vegetable gross output and field crops area, in hectares. Also in this model there were six cases with estimated values far below of its real value : Madrid unirrigated farmland in Madrid, irrigated farmland in Cataluña, irrigated farmland in Baleares, Cataluña, Madrid and Andalucía and nuts and dried fruit-trees in Andalucía. In consequence, they were removed and the analysis was repeated, obtaining result showed in table nº 5.

Table n 5.

Resumen del modelo

Modelo	R	R cuadrado	R cuadrado corregida	Error típ. de la estimación
1	,862[a]	,743	,719	***********

a. Variables predictoras: (Constante), ALA.HE.H, PB (Pta/Ha)

Coeficientes[a]

Modelo		Coeficientes no estandarizados B	Coeficientes no estandarizados Error típ.	Coeficientes estandarizados Beta	t	Sig.
1	(Constante)	3634514	459252,3		7,914	,000
	PB (Pta/Ha)	2,070	,340	,714	6,085	,000
	ALA.HE.H	-,569	,239	-,279	-2,380	,026

a. Variable dependiente: Precio Testigo

Being VTestigo the sample price in thousands of pesetas per hectare, the equation has the following expression:

VTESTIGO = 3.634.514 + 2,070 PB - 0,569 ALAHEH (#5)

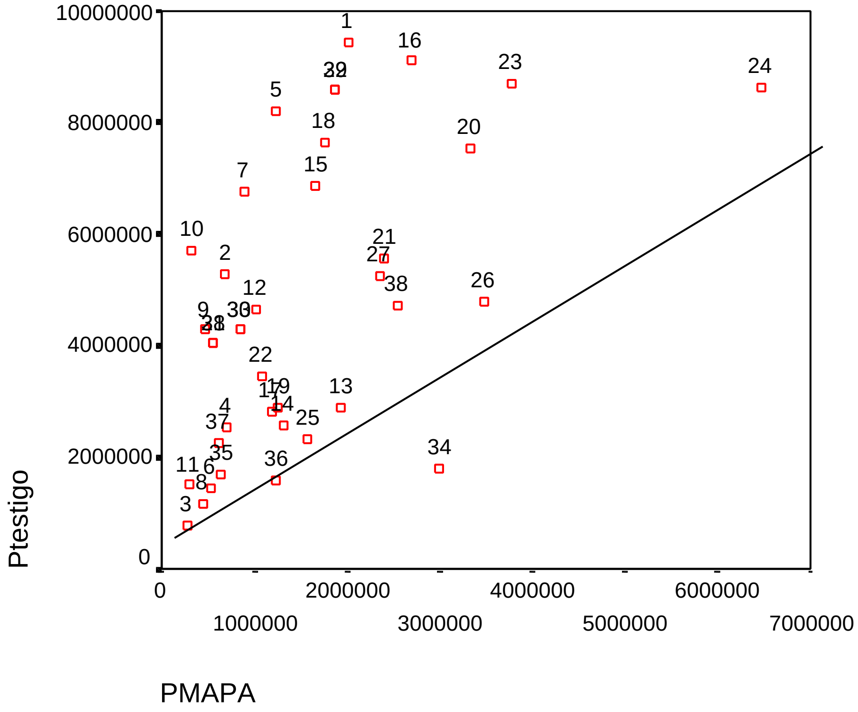
From the comparison between this model and the model (#4) obtained in epigraph 5 we can deduce the following:

1) Using explanatory variables related to the crop and localization of the autonomous region we are able to explain more than 70% of the variability of the price of the farmland. The rest (30%), would come defined by specific variables of the parcel (form, size, microclimate, etc..) and by the specific circumstances of the deal.
2) The variable refered to the crop is picked up in the first model by the type of crop (herbaceous or fruit tree) and the holding of water, while in the second is through the vegetable gross output.
3) The variable localization of the autonomous region is explained in the official prices of the MAPA for the rainfall, the sea and the number of farms per autonomous communitie, while in the sample prices the localization is represented by the variable field crops area, in hectares. In the second model, the bigger the variable field crops area is, smaller the average farmland price of a community is.

7. RELATIONSHIP BETWEEN THE OFFICIAL PRICES AND THE SAMPLE PRICES OF THE APRAISAL COMPANY

It is interesting to see which the relationship exists between the two sources of prices data. On one hand, to see if both prices are concordant and, for other, to study the possibility of building the sample prices of the appraisal company using the official prices.

Figure 2. Prices of the farmland according to the MAPA and sample prices of the appraisal company, in pesetas per hectare, in the year 1998.



At first sight, it is easy to see, in the figure nº 2, how the sample prices are always greater than the official prices, with the only exception of vineyard for table grapes in the community of Valencia. The cases with the greater differences are Galicia and Baleares. As we have seen in previous paragraphs they are also the communities with some the higuest official prices of the farmland.

The value of the sample prices could be greater up to 9 times the official prices.

It is interesting the construction of a model that estimates the sample price of the appraisal company depending on the official prices. We have repeated the the analysis including as new independent variable the official price in the matrix of explanatory variables.

The result, in which some cases were removed, is shown in table nº 6. The removed cases were: irrigated farmland in Canarias and fruit trees culture in Andalucia with an estimated valued lower than the sample price and vineyard of table grape in Valencia with a higuer value than the sample price.

Table nº 6.

Resumen del modelo

Modelo	R	R cuadrado	R cuadrado corregida	Error típ. de la estimación
1	,840[a]	,706	,669	***********

a. Variables predictoras: (Constante), PASTTOT, ALS.VI.H, IPC.VIVI, Precio Mapa

Coeficientes[a]

Modelo		Coeficientes no estandarizados		Coeficientes estandarizados	t	Sig.
		B	Error típ.	Beta		
1	(Constante)	-2,0E+07	5679327		-3,538	,001
	Precio Mapa	,936	,212	,448	4,424	,000
	ALS.VI.H	-6,970	2,400	-,285	-2,905	,007
	IPC.VIVI	189079,8	43008,837	,429	4,396	,000
	PASTTOT	-57206,1	24399,033	-,235	-2,345	,025

a. Variable dependiente: Precio Testigo

According to the model, the sample price "VTestigo"in thousands of pesetas per hectare:

VTESTIGO = -20.000.000 + 0,936 PMAPA + 189.079,8 IPCVIVI - 6,97 ALS.VI.H. - 57.206 PASTOT

Being the explanatory variables:

PMAPA: Official price of the farmland according to MAPA survey in thousands of pesetas per hectare

IPC.VIVI:. Annual average of the index of prices in housing

ALS.VI.H.: Hectares of ploughed vineyard land.

PASTOT: Percentage of area of grasses over the total area of the autonomous region.

This means that the sample prices might be obtained from the official prices of the MAPA, besides the index of prices in housing and two other variables. The index of prices in housing has a positive coefficient, it increases the sample price, the two other variables reduce the sample price (negative coefficient)

This is evident, if we realized that the sample prices are used for appraisal companies on mortgages. The appraisers are influenced by the market of housing, defined by the variable IPCVIVI, and they undervalue certain farmlands as the refered.

7. CONCLUSIONS.

?? According the analyzed references, the econometric models to estimate the farmland prices obtained in Spain in the last years, are refered to microspatial scopes. In this work a model of national scope has been developed. It tries to explain the farmland value in function of the autonomous communities.

?? We have been used of two different data sources: the survey of prices of farmland elaborated by the Ministry of Agriculture (MAPA), the sample data of a company of appraisal with mortgage finality. The average sample prices are greater than the official prices published by the MAPA, up to 9 times in some cases. This fact does not imply any mistake in anyone of the sources. Rather the differences are due to the purpose that each one pursues in their definition of the prices.

?? It is feasible to explain the average farmland price for each region through econometric methods, as much for official prices as for sample prices. The obtained coefficients of determination were always higher than 70%.

?? From the data of the official survey of farmland prices from the year 1983 up to 1999, a model has been built. This model tries to explain the value of field crops lands in function of the time, the holding of water and the autonomous region. The obtained model indicate an increase of the average value of the hectare of irrigated land over unirrigated land of 743.400 pesetas for the base year 1983, a decrease of the price of the farmland in real terms of 15.120 pesetas for hectare and year from 1983, as well as the differences of value among the autonomous communities. The highest value took place in Galicia and the lowest in the communities of Castilla-La Mancha and Extremadura.

?? In analogue way another model has been built for all the crops (not only field crops). The variable woody-field has been added. In this model, the irrigation increases the price of the hectare of farmland in 1.232.423 pesetas, the average value of the trees is 568.629 pesetas per hectare. It is deduced too that in the nineties the average official price of farmland has not varied.

?? The variables vegetable gross output and farm subsidies are not the more influential in the official price of the farmland. On the opposite, this official price of farmland for each region is formed by two parameters : the crop and the localization. The crop is explained with the holding of water and the woody/field variable, while the localization is built with the regional rainfall, the presence of sea coast and the amount of farms in the region out of the amount of farms in the nation.

?? In the same way the sample prices of a appraisal company for each region and crop are made up by the crop and the localization. Nevertherless, the crop is defined in this case by the vegetable gross output and the localization effect by the variable field crops area.

?? A model that estimates the sample prices in function of the farmland prices of the survey of the MAPA, and other three variables has been developed.. One of them is the index of prices of housing, which is very relevant. This could indicate the notable influence of the urban real estate appraisals over the farmland appraisals in the companies of appraisal. We should not forget that the greater percentage of their billing comes by urban real estate appraisals and that the farmland appraisals are merely residuals.

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