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Land value and returns on Farmlands: an analysis by Spanish Autonomous Regions

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Abstract

Although the discounted cash-flow is still considered to be the fundamental value of an asset, there are few studies which assess its ability to explain movements in the market prices of agricultural assets. The aim of this work was to compare the evolution of market prices of Farmland to the series of values that would be obtained by applying the income approach method using official Spanish statistical data as well as two proposed methods: on the similarity of the dynamical structure of prices and returns time series, on the one hand; and on the regression between both series, on the other. The results obtained are not consistent with the hypothesis that the values obtained by the income approach method can explain the movements observed in market prices. Only in certain isolated cases, such as the Autonomous Region of Aragón. Therefore, other causes should be considered both at national and regional level.

Additional key words: DCF model; fundamental value; income approach; market price.

Resumen

Valor de la tierra y rendimiento de las explotaciones agrarias: un análisis por comunidades autónomas

Aunque el descuento de flujos de caja sigue siendo considerado el valor de un activo, son escasos los estudios destinados a contrastar su capacidad de explicar los movimientos en los precios de mercado de los activos agrarios. El objetivo de este trabajo es el de comparar la evolución de la serie de precios de mercado de la tierra de uso agrario con la serie de valores que se obtendría de la aplicación del método analítico utilizando datos procedentes de las estadísticas oficiales españolas a través de dos métodos propuestos: uno sobre la similitud de la estructura dinámica de las series de precios y rendimientos, y otro sobre las regresiones entre ambas series. Los resultados obtenidos no son congruentes con la hipótesis de que los valores obtenidos con el método analítico puedan explicar los movimientos observados en los precios de mercado. Solo en casos aislados, como en la Comunidad de Autónoma de Aragón, se podría admitir que la evolución de los rendimientos de las explotaciones explicaría la evolución de los precios de la tierra. Por ello, tanto a nivel nacional, como en la mayoría de las comunicadas autónomas otras causas deberían ser consideradas.

Palabras clave adicionales: método analítico; modelo de descuento de los flujos de caja; precio de mercado; valor fundamental.

Introduction

According to valuation theory, the predictable present value of cash-flows that an asset is expected to generate is still accepted as being the fundamental value of an asset; thus, the applied discount rate should consider the associated risk when obtaining those cash-flows. This procedure is also widely used in Farmland appraisal, being identified as the income approach valuation method. However the discounted variable is not always the same as the net cash-flows, which is usual in both financial asset and firm valuation.

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Abbreviations used: AR (autonomous region); DCF (discounted cash-flow); EDU (economic dimension units); ENPT (*Encuesta Nacional de Precios de la Tierra,* National Survey of Land Prices Rate); ETO (economic trend orientations); MARM (*Ministerio de Medio Ambiente, Rural y Marino*; Spanish Ministry of Environment; Rural and Marine Affairs); RCAN (*Red Contable Agraria Nacional,* National Agricultural Accounting Net); UTA (*unidad de trabajo agrario,* agricultural labour unit).

Although the income approach method has been widely used in agricultural valuation, there are few studies which assess its ability to explain the movement in the market prices of Farmland. Certain studies carried out in the USA have found some evidence showing that expected returns on Farmland do not explain the variation in prices in the land market, especially when using the simplest version of the valuation model, which involves discounting these returns at a constant rate. Phipps (1984) shows that the returns on Farmland are considered to be lower than returns on other investments; therefore, the maintenance of the investment and the conservation of land property should be explained by this investment's ability to generate additional utilities in addition to returns on agricultural use: these utilities will basically be linked to the guarantee of obtaining capital gains derived from their future sale, which implies accepting that the prices of Farmland cannot be explained by their fundamental value.

Traditionally, the investment in Farmland was linked to production activities in the farm sector; therefore, it was assumed that the net returns on the production activities carried out on the land would condition its value; however, as a consequence of economic development, alternatives other than the agricultural use of land, including mainly urban, but also industrial and leisure uses have appeared. These uses have led to the increased demand for this land which is limited in supply, and have been used to explain the further increase in land prices due to expectations regarding the agricultural returns to be generated as a result of this evolution in prices. A direct consequence of this increase in prices is the trend to consider land to be an alternative investment, which together with other kind of properties will compose an investment portfolio which is not solely agricultural.

The existing relationship between the market prices of Farmland and the returns on agricultural exploitations have been studied by several researchers; Falk (1991), Clark *et al.* (1993), Falk & Lee (1998), Turvey (2002) and Foster (2006) focused on the analysis of dynamics of serial data for prices and returns, concluding that due to the differing behaviour of both serial data, the income approach model could not sufficiently explain the behaviour of the price market, or at least the simplest version of this model; therefore, more complex models which consider other factors should be considered in the valuation of land. Tegene & Kuchler (1993), contrast the validity of the model of capitalization by means of the regression of the serial data of land market prices on the serial data of values estimated by the income approach model, checking that the obtained regression line does not coincide with the bisecting line of the first quadrant (coordinates at origin equal to zero and slope equal to one) as would be expected if the fundamental value and the market value were the same.

Since the valuation model, or at least the simplest version of this model, which considers a constant rate of return, does not seem to satisfactorily explain the land market values, the analysis of factors which influence the value of Farmland has been the object of a broad scientific discussion which ranges from the explicit incorporation of capital gain expectations in the valuation models (Melichar, 1979; Plaxico & Kletke, 1979; Segura *et al.,* 1984; Moss, 1997); to the use of models based on the hedonic prices (Chicoine, 1981; Gómez, 1996; Arias, 2001; Sala & Torres, 2002; Gracia *et al.*, 2004); and recently, the behaviour of the economic agents which are of interest, such as risk aversion and the effect of transaction costs, has been included in the land valuation models (Chavas & Thomas, 1999; Lence & Miller, 1999; Lence, 2001; De Fontnouvelle & Lence, 2002).

On the other hand and from a tax viewpoint, there has been discussion regarding the most equitable method for valuating land: the market value or the capitalized value of the returns generated. Obviously, both values would tend to be the same if the land were intended for agricultural use and there were no expectations regarding alternative uses, however in view of the continuous increase in land prices, the tax load on the systems based on market prices would grow even when the agricultural returns decrease, which would lead to an increase in the lack of feasibility of agricultural companies under a situation of generalized crisis, such as the current economic backdrop.

The tax impact of the model used in the valuation of agricultural assets, which avoids the possible risk to agricultural firms resulting from continuous increases in the market prices, has been posed by Shane *et al.* (2003), generating a possible problem of funding for the local administration, the main recipient of these taxes (Chicoine & Hendricks, 1985). In Spain the main reference for valuation under a tax approach is the cadastral value. The current rule (BOE, 2004) establishes the tax base for property tax (IBI, *Impuesto sobre Bienes Inmuebles*) which should take the market value as a reference without exceeding it; additionally, the competent administration should establish a valuation rule, supported by market studies and official table values, which allow the cadastrial value to be estimated by taking market value as a reference and upper limit; nevertheless, its application to rural land has not reached the foreseen objectives (Alcázar & Ariza, 2004).

The recent modification of the Spanish legislation on the valuation of rural land in case of compulsory purchase due to its change of use has reopened the debate on this issue in our country. Thus, some questions have arisen such as whether there are significant disagreements in Spain between the fundamental value of the land, as a main agricultural asset, and land market prices.

The aim of this study is to compare the evolution of the market price series of Farmland with respect to the price obtained through the application of the income approach method, studying the existing relationship between them. The first issue is the availability of data; given that since the study is based on the official statistics of the MARM (*Ministerio de Medio Ambiente, Rural y Marino*; Spanish Ministry of Environment; Rural and Marine Affairs), some of the serial data is not extensive enough. Since 1983 the Spanish Administration has conducted the ENPT for Farmland; the main objective of this survey being to measure the evolution of the average price level of the most significant croplands; in other words, free lands for sale intended to be used for agriculture. Since 1998 this statistical information has been complemented with data on the evolution of paid rental rates, and therefore the returns serial is too short to carry out any comparative analysis. As an alternative to the return data, this study is based on data from the RCAN, which covers approximately the same period as the ENPT.

Methodology

The income approach model (based on the present value of returns)

Under the income approach method of valuation the value of a farm is equal to the present value of future returns (actual or potential) which the farm is able to generate, discounting these returns at a proper rate; this value is given by the following expression:

$$P_t = \sum_{i=o}^{\infty} \frac{E(R_{t+i})}{(1+r)^i}$$

Being P_t the land value at the beginning of year t; $E(R_{t+i})$ the expected value of the return by the end of the year $t+i$ and r the discount rate which can be considered constant. The equation can be modified as follows:

$$P_t = \sum_{i=o}^{T} \frac{E(R_{t+i})}{(1+r)^i} + \frac{1}{(1+r)^T}\left[\sum_{j=o}^{\infty} \frac{E(R_{T+i})}{(1+r)^i}\right]$$

Obviously, the expression inside the brackets is the estimated value for the year T; if this value and the returns serial data for the period t and the T are known, it is easy to estimate the land values serial data which could be obtained by applying the income approach method of valuation; if P_t is the best estimation of the land value for the year T, for the previous year T-1 the estimation would be:

$$P_{T-1} = \frac{E(R_{T-1})}{(1+r)} + \frac{P_T}{(1+r)} = \frac{1}{(1+r)}(E(R_{T-1}) + P_T)$$

In general, the best estimation for any year would be the present value as the sum of expected returns for this year and the estimated land value for the following year, assuming that the expected return is obtained at the end of the period and that the land value is considered at the beginning of the period:

$$P_t = \frac{E(R_t)}{(1+r)} + \frac{P_{t+1}}{(1+r)} = \frac{1}{(1+r)}(E(R_t) + P_{t+1})$$

Similarly, the land return can be estimated as the difference between the land value at the beginning of each year capitalized at the end thereof and the land value at the beginning of the following year (Phipps, 1984).

In all cases, if the income approach method estimates the land value properly, the prices serial data estimated by the previous equation and the market prices serial data should have analogous behaviour; Tegene & Kuchler (1993) suggest that if the previous proposition is true, the regression of one serial on the other should be a line which passes through the origin and has a slope equal to one, posing a serial of statistical tests in order to contrast this hypothesis. Falk (1991) concludes that if the method were to estimate the value properly, both series would have the same dynamic behaviour, which implies that the filters needed to transform the serial data into stationary data would be the same. In both cases the authors conclude that the hypothesis of the model based on the returns discount will provide a good estimation of the observed market values. The differences observed could not be attributed to mistakes in measurement given that they have an economic base, either due to the existence of rational bubbles (bubbles which reflect the trend of an asset price to deviate from its fundamental value in a non-stationary way as a result of the belief that prices depend on a variable or a group of variables which are irrelevant in an intrinsic way with respect to the fundamental value of the assets) or other possible explanations such as the assumption that with respect to investment behaviour, the discount rate is considered to vary with time.

Both Falk (1991) and Tegene & Kuchler (1993) apply models used for the study of stock market prices and movements to study Farmland prices and movements. First and from the methodology used by Tegene & Kuchler, this paper studied how well the present value model explains the Spanish Farmland price movements under rational expectations. Thus, market prices are regressed on the values estimated by the income approach method, imposing restrictions on the intercept and slope parameters of regression equations (Null hypothesis, H_0: intercept = 0 and slope = 1, simultaneously). On the other hand, Falk (1991) considers that, when market expectations are formed rationally on the basis of an information set, if the returns evolve on the basis of a difference stationary process, it can be checked how Farmlands prices also evolve as a difference stationary process. This study questions whether the statistical information available in Spain evidences the validity of the income approach method for use in explaining the movement of prices in the land market. Thus, the land prices serial data is based on the ENPT. Since 1983, the MARM, jointly with the Spanish ARs, has continuously carried out a Farmland prices survey. The aim of this statistical information is to report on the evolution of the average prices level of the most significant croplands, in other words, free land for sale mainly intended for agricultural use. The representative criterion for the land at a regional level is given by the surface of this kind of cropland; and the collection of information is the responsibility of the agricultural statistics services of the different ARs through their provincial units. The experts complete a questionnaire with the observed prices (or, otherwise, estimated prices) for each kind of cropland and the transactions carried out at each territorial unit considered. On this basis, the information can be elaborated and summarized at a provincial, AR, and national level[1].

In order to analyze the evolution of the results of the land for agricultural use, the RCAN data was used. The field of observation of the RCAN is comprised by agricultural exploitations with an economic dimension of at least two EDUs and from all the ETO forming the base. Although the period observed is practically the same as in the case of the national land prices survey, there is an important delay in the publication of the RCAN results, therefore for the last years of the period only the national data is available.

Taking into account the RCAN methodology, the variable which would initially have to be considered would be “business availabilities”, defined as the net added value to the cost of the factors minus wages, rental rates and interest paid. The difference between this concept and the potential income defined by the law would be the wages assigned to the family labour employed on the farm, although the remuneration of other working capitals used in the exploitation and, logically, the firm’s profit, should also be included.

The wages allocated to the family labour can be estimated based on the average national wages available in the statistical database of the MARM and the information from the RCAN on the labour employed in the exploitations[2]. Thus, this variable could be assimilated as the return of the farm, often used for the purposes of agricultural valuation, or, even, the net cash-flows plus the amortization used for the valuation of companies. However, given our interest in the evolution of the returns and the model of behaviour which they have followed during the period, the variable directly provided by the RCAN was used, assuming that the family labour retribution and the rest of the factors employed in the exploitation are a fixed part of the business availabilities and, therefore, their evolution also reflect the net returns. The business availabilities obtained from the RCAN were deflated with the same index used by the ENPT in order to deflate the serial data, the values used in the analyses are in euros and the average rate of 3.28% provided in the work carried out by Ribal (2003) was used to estimate the discount rate.

[1] They have been obtained by the time series modeling assistant of the SPSS 16.5 software.

[2] From the evolution of real wages and the quantity of family labor used in the exploitations, it could be deducted they do not have any kind of influence on the variability observed in the business availabilities.

Results

In the period 1983-2009 the value of land for agricultural use has grown, in real terms, at an annual average rate of 0.59%; however, this value's behaviour has been uneven for the period. The average annual variation rate for the period is also positive: 0.82%, although the standard deviation is also high, about 6.71%, presenting negative values for the third part of the years which the period comprise. In fact, this returns serial data is adjusted to an integrated process of order 1, whose first difference follows a random walk with constant, even though in this case the constant will not differ significantly from zero.

The evolution of average land prices at an AR level during this period present a great variability (Table 1). Just 7 of the 17 ARs have positive real growing rates, and although the average values of the annual variation rates are positive in 10 ARs, the volatility of these values is very high. In fact only Cantabria and the Islas Canarias present volatilities lower than the values observed for the national set, and in the País Vasco, Madrid and the Islas Canarias a very high volatility is observed in relation with the national average.

With respect to the serial data of prices, since it showed evidence of non-stationarity, we applied an autoregressive integrated moving average (ARIMA) model; most of the data obtained follow an integrated process of order 1, therefore the first difference, that is to say the variation of the annual rates serial data follow a random walk, although in any case the constant will differ significantly from 0 at a 95% level of significance. Only for the ARs of Cantabria, Castilla y León, Valencia, Extremadura and Andalucía is the model of behaviour similar to the national set: the prices follow an integrated process of order 2, and therefore the annual growing rate is an integrated process of order 1 and their first difference will follow a random walk. Only in Cataluña, Castilla La Mancha and Región de Murcia is it necessary to apply an autorregressive filter of order 1. Table 2 shows statistical results of the ARIMA model for prices.

During the period 1983-2009 the business availabilities have dropped, in real terms, at an annual average rate of 0.37%, nevertheless an uneven behaviour has been observed during the period; the variation of the average annual rate of the period is positive: 2.72%, although the standard deviation is high, 23.04%, tripling the volatility observed in the values of the land price. The values of the negative variation rates appear practically in half of the years which comprised the period. The serial data of business

Table 1. Evolution of land prices by ARs (measured in constant 1983 prices)

	Annual cumulative rate (%)	Annual average rate for the period (%)	Variability of the rate (%)	Relative volatility
Galicia	–0.88	–0.35	10.85	1.62
Asturias	–0.80	–0.10	12.64	1.88
Cantabria	–3.24	–3.13	4.81	0.72
País Vasco	1.21	2.73	17.83	2.66
Navarra	–0.29	0.11	9.53	1.42
La Rioja	–0.43	0.12	10.57	1.57
Aragón	–2.36	–1.57	13.35	1.99
Cataluña	–0.84	–0.58	7.09	1.06
Islas Canarias	–0.09	0.10	6.28	0.94
Castilla y León	–0.51	–0.17	8.06	1.20
Madrid	0.40	1.49	15.61	2.32
Castilla La Mancha	0.56	0.90	8.47	1.26
Comunidad Valenciana	–0.59	–0.21	8.62	1.28
Región de Murcia	0.39	0.83	9.53	1.42
Extremadura	0.44	0.79	8.50	1.27
Andalucía	2.89	3.27	8.90	1.32
Islas Canarias	4.03	5.20	15.88	2.36
Spain	0.59	0.82	6.71	1.00

Source: Author's own elaboration using data from the MARM (Rental Rates National Survey and Land Prices National Survey).

Table 2. ARIMA models for the land prices serial data

	Model	Data	Parameter	Estimation	Error terms	t	Sign.
Galicia	ARIMA(0,1,0)	Original	Constant	–44.544	107.473	–0.414	0.682
Asturias	ARIMA(0,1,0)	Original	Constant	–27.713	102.833	–0.269	0.790
Cantabria	ARIMA(0,2,0)	Original	Constant	9.373	44.766	0.209	0.836
País Vasco	ARIMA(0,1,0)	Original	Constant	46.461	115.209	0.403	0.690
Navarra	ARIMA(0,1,0)	Original	Constant	–8.908	41.529	–0.214	0.832
La Rioja	ARIMA(0,1,0)	Original	Constant	–14.421	76.966	–0.187	0.853
Aragón	ARIMA(0,1,0)	Original	Constant	–36.005	31.327	–1.149	0.261
Cataluña	ARIMA(1,1,0)	Original	AR Delay 1	0.563	0.163	3.462	0.002
Islas Canarias	ARIMA(0,1,0)	Original	Constant	–4.999	60.346	–0.083	0.935
Castilla y León	ARIMA(0,2,0)	Original	Constant	1.096	18.134	0.060	0.952
Madrid	ARIMA(0,1,0)	Original	Constant	10.508	70.889	0.148	0.883
Castilla La Mancha	ARIMA(1,1,0)	Original	AR Delay 1	0.443	0.179	2.472	0.021
Comunidad Valenciana	ARIMA(0,2,0)	Original	Constant	–59.613	105.227	–0.567	0.576
Región de Murcia	ARIMA(1,1,0)	Original	AR Delay 1	0.435	0.180	2.417	0.023
Extremadura	ARIMA(0,2,0)	Original	Constant	–0.603	18.878	–0.032	0.975
Andalucía	ARIMA(0,2,0)	Log natural	Constant	0.000	0.017	–0.044	0.965
Islas Canarias	ARIMA(0,1,0)	Log natural	Constant	0.040	0.030	1.306	0.203
Spain	ARIMA(0,2,0)	Log natural	Constant	–0.001	0.011	–0.122	0.904

Source: Authors' own elaboration.

valuation can be modeled as an integrated process of order 1, therefore the business valuation serial data obtained would follow a random walk with constant, even though in this case the constant did not differ significantly from zero too.

Table 3 shows that during this period the evolution of the business availabilities at an AR level present a great volatility. There is a positive real growing rate for nine communities, with high real values in some cases like Andalucía; the average values of the annual

Table 3. Evolution of the business availabilities by ARs (measured in constant 1983 prices)

	Annual cumulative rate (%)	Annual average rate for the period (%)	Variability of the rate (%)	Relative volatility
Galicia	3.49	8.02	32.87	1.43
Asturias	1.62	9.07	46.34	2.01
Cantabria	–0.24	6.27	38.39	1.67
País Vasco	–4.68	–2.87	63.52	2.76
Navarra	–0.82	7.51	44.29	1.92
La Rioja	1.71	8.67	41.95	1.82
Aragón	–0.76	7.01	49.27	2.14
Cataluña	–2.28	1.99	31.95	1.39
Islas Canarias	5.20	–44.12	171.04	7.42
Castilla y León	0.72	5.51	34.32	1.49
Madrid	3.79	22.69	99.62	4.32
Castilla La Mancha	4.98	7.45	23.04	1.00
Comunidad Valenciana	3.64	6.60	26.31	1.14
Región de Murcia	–0.30	14.62	60.56	2.63
Extremadura	–1.83	3.36	34.36	1.49
Andalucía	6.24	14.66	50.58	2.20
Islas Canarias	–1.34	0.50	78.85	3.42
Spain	–0.37	2.72	23.04	1.00

Source: Author's own elaboration using data from the RCAN.

variation rates are positive in almost all of them; however, the volatility of these values is very high, higher than observed for the serial data of land prices, with an extreme case in the Islas Canarias, and also with high values in Madrid and the Islas Canarias. It should be remarked that there is no important correlation between both serial data.

With respect to the business availabilities serial data, only in the ARs of the Islas Canarias, Castilla y León, Castilla La Mancha, the Comunidad Valenciana and Andalucía do the models obtained follow an integrated process of order 1, therefore its first difference; that is to say, the serial data of annual rates follow a random walk with derive, even though in any case the constant will differ significantly from 0 to 95%. In the communities of the Rioja, Región de Murcia and the Islas Canarias the serial data follows an autorregressive process of order 1. In the rest of the cases the serial data (or its values transformed by the national logarithm) directly follow a random walk with constant equal to the average value of the observed data (Table 4).

From the deflated serial data, the serial data of land prices which derive from the application of the income approach method to the national set and the different ARs have been calculated. As an estimator of the returns we have used the business availabilities of the RCAN whose last available year was *T* (2007 for the national set and 2005 for the different ARs). In order to check the existing relationships between both of them, we have applied the test proposed by the two methods (on the similarity of the dynamical structure of prices and returns time series, on the one hand; and on the regression between both series, on the other).

With respect to the second approach, the ordinates at origin should not be expected to be zero, since the variable used overestimates the value of the exploitation rent, at least, with respect to family labour wages. Therefore, the ordinate intercept should be expected to have a positive value, but the slope should not differ significantly from 1 if the valuation model explains the cash-flows behavior.

The results obtained are contrary to the forecasts. The slope of the regression line is negative for the national set and for most of the ARs, and only for six ARs (Galicia, Asturias, Cantabria, La Rioja, Aragón and Cataluña) is the slope positive. However, in only one case, Aragón, both conditions of the null hypothesis could be accepted (Table 5). Therefore, and except for the Aragón ARs, it should be concluded that the

Table 4. ARIMA models for the business availabilities serial data

	Model	Data	Parameter	Estimation	Error terms	t	Sign.
Galicia	ARIMA(0,0,0)	Log natural	Constant	6.294	0.057	111.267	0.000
Asturias	ARIMA(0,0,0)	Log natural	Constant	5.915	0.064	92.643	0.000
Cantabria	ARIMA(0,0,0)	Original	Constant	404.707	22.484	17.999	0.000
País Vasco	ARIMA(0,0,0)	Original	Constant	317.912	37.667	8.440	0.000
Navarra	ARIMA(0,0,0)	Original	Constant	196.388	12.714	15.447	0.000
La Rioja	ARIMA(1,0,0)	Original	Constant	577.317	86.549	6.670	0.000
			AR Delay1	0.539	0.185	2.909	0.009
Aragón	ARIMA(0,0,0)	Log natural	Constant	4.841	0.059	82.205	0.000
Cataluña	ARIMA(0,0,0)	Original	Constant	331.520	23.541	14.083	0.000
Islas Canarias	ARIMA(0,1,0)	Original	Constant	26.494	15.701	1.687	0.112
Castilla y León	ARIMA(0,1,0)	Original	Constant	0.798	8.357	0.095	0.925
Madrid	ARIMA(0,0,0)	Original	Constant	190.380	50.576	3.764	0.001
Castilla la Mancha	ARIMA(0,1,0)	Log natural	Constant	0.049	0.049	0.991	0.334
Comunidad Valenciana	ARIMA(1,0,0)	Original	Constant	25.304	30.137	0.840	0.411
Región de Murcia	ARIMA(1,0,0)	Square root	Constant	25.916	2.700	9.600	0.000
			AR Delay1	0.473	0.196	2.419	0.025
Extremadura	ARIMA(0,0,0)	Log natural	Constant	4.776	0.055	87.244	0.000
Andalucía	ARIMA(0,1,0)	Log natural	Constant	0.061	0.086	0.704	0.490
Islas Canarias	ARIMA(1,0,0)	Original	Constant	3938.625	1243.274	3.168	0.005
			AR Delay1	0.519	0.188	2.753	0.012
Spain	ARIMA(0,1,0)	Original	Constant	-0.502	8.862	-0.057	0.955

Source: Authors' own elaboration.

Table 5. Tegene & Kuchler (1993) test statistics results

	H_0: α = 0		H_0: β = 1	
	t-statistics	Probability	t-statistics	Probability
Galicia	8.9501	0.0000	–17.5652	0.0000
Asturias	2.1636	0.0429	–5.5841	0.0000
Cantabria	–0.6793	0.3107	–3.8718	0.0010
País Vasco	10.3168	0.0000	–12.7121	0.0000
Navarra	3.6041	0.0019	–5.0721	0.0001
La Rioja	2.3716	0.0288	–9.8101	0.0000
Aragón	0.0553	0.3938	–2.0000	0.0578
Cataluña	3.8831	0.0010	–7.8300	0.0000
Islas Canarias	4.9986	0.0001	–5.2527	0.0000
Castilla y León	5.2281	0.0000	–9.0796	0.0000
Madrid	4.6678	0.0001	–7.3456	0.0000
Castilla La Mancha	16.4557	0.0000	–23.6984	0.0000
Comunidad Valenciana	4.5802	0.0002	–7.3052	0.0000
Región de Murcia	7.3515	0.0000	–17.4828	0.0000
Extremadura	5.9760	0.0000	–9.0085	0.0000
Andalucía	10.7720	0.0000	–11.9518	0.0000
Islas Canarias	12.9025	0.0000	–25.9434	0.0000
Spain	8.0775	0.0000	–10.7385	0.0000

Source: Authors' own elaboration.

market prices of land for agricultural use have behaved differently than forecast by the income approach valuation model.

With respect to the contrast approach proposed by the first method, the disparity in behaviour which derives from the prices serial data and business availabilities analysis, suggests that it is difficult to accept the income approach model as a fundamental basis for explaining the behaviour of the land prices. Certainly, in general the prices serial data have an order of integration higher than the return serial data, which are not in line with the first approach assumptions that if the valuation model is valid and the returns follow a stationary differential process, it can be demonstrated that the prices serial data should also follow the same process. As it was observed with some business availabilities serial data follow a stationary differential process while others are directly stationary. On the contrary, the prices serial data always follow a different model. With the same software, the behaviour of the serial data values estimated from income approach models has been estimated, showing (Table 6) how their behaviour differs from the business availabilities serial data on which they are based in an integration grade; with relation to the land prices market serial data a formal equality of the models of 50% is observed, however the estimated parameters are quite different in four cases: Galicia, Asturias, País Vasco and Madrid, in which the constant does not differ significantly from zero in the market price serial data, while it is negative and significantly different from zero in the serial data estimated by income approach model. In the other two cases, Andalucía and the national average, although the models are the same in form, in the case of the market prices they are obtained from the logarithmic transformation of the data, while in the case of the estimated values serial data, it is applied on the data without transforming them. In other cases, Castilla y León and the Comunidad Valenciana, it could be concluded that the market prices serial data behavior and the serial data of values estimated by the model are the same.

Discussion

The results of our study are similar to those found by most of the researchers who have studied the relationship between Farmland prices and returns. Coinciding with them, it can be concluded that the economic returns on Farmlands are not sufficient for explaining the behaviour of market prices. Therefore, the addition of factors such as the capital gain expectations, the existence of transaction costs, the investors' risk aversion, etc. should be considered in the valuation model.

Table 6. ARIMA models for the prices estimated by the income approach serial data

	Model	Data	Parameter	Estimation	Error terms	t	Sign.
Galicia	ARIMA(0,1,0)	Original	Constant	–267.874	32.463	–8.252	0.000
Asturias	ARIMA(0,1,0)	Original	Constant	–176.710	34.976	–5.052	0.000
Cantabria	ARIMA(0,1,0)	Original	Constant	–190.241	22.375	–8.502	0.000
País Vasco	ARIMA(0,1,0)	Original	Constant	–133.932	37.137	–3.606	0.002
Navarra	ARIMA(1,1,0)	Log natural	Constant	–0.023	0.006	–3.574	0.002
			AR Delay 1	0.464	0.198	2.346	0.029
La Rioja	ARIMA(0,2,0)	Original	Constant	–18.011	47.224	–0.381	0.707
Aragón	ARIMA(0,2,1)	Original	MA Delay 1	0.712	0.171	4.173	0.000
Cataluña	ARIMA(0,1,0)	Original	Constant	–168.854	20.504	–8.235	0.000
Islas Canarias	ARIMA(0,2,0)	Original	Constant	–12.699	18.621	–0.682	0.503
Castilla y León	ARIMA(0,2,0)	Original	Constant	–2.939	8.196	–0.359	0.724
Madrid	ARIMA(0,1,0)	Original	Constant	–78.559	50.043	–1.570	0.131
Castilla La Mancha	ARIMA(0,2,0)	Original	Constant	–6.684	7.465	–0.895	0.381
Comunidad Valenciana	ARIMA(0,2,0)	Original	Constant	–35.190	29.661	–1.186	0.249
Región de Murcia	ARIMA(0,1,0)	Original	Constant	–460.685	94.780	–4.861	0.000
Extremadura	ARIMA(0,1,0)	Original	Constant	–59.256	6.564	–9.027	0.000
Andalucía	ARIMA(0,2,0)	Original	Constant	–13.934	17.638	–0.790	0.439
Islas Canarias	ARIMA(0,2,0)	Original	Constant	–26.481	718.466	–0.037	0.971
Spain	ARIMA(0,2,0)	Original	Constant	–1.963	8.691	–0.226	0.823

Source: Authors' own elaboration.

With regard to both the methods proposed by Falk (1991), with respect to the similarity of the dynamical structure of the time series of prices and returns, and the methods proposed by Tegene & Kuchler (1993), regarding the regression between market prices series with the ones estimated by the income approach method for the same period of time, it can be concluded that the income approach method is not suitable for analyzing the evolution of market prices. While the returns series used come from statistical sources other than the prices serial data, and the business availabilities overestimate the yield variable often used in agricultural valuation, the discrepancies found in comparison to the theoretical expected behaviour are so wide that they can hardly be attributed to these factors. If the RCAN collects the economic returns on Spanish agricultural land property and the ENPT collects data on the market prices of the Farmland, the valuation model derived from the application of the income approach method does not explain the evolution of the market prices.

An important issue to be considered is if the length of the series can influence these results; unlike the studies of reference, the national series only have a range of 27 years, while the other studies have a range of 80 years. This difference in length could be the cause of the great volatility of the Farmland returns, usually considered to be more stable than the land prices, taking into account that during this period of time, there were many changes and adjustments in the national agricultural sector, as well as an important crisis which became apparent in the negative trends observed during this period of time in different ARs; on the contrary, land prices are more stable and with a generalized positive trend, therefore other economic variables should affect the market prices and should be included in the valuation model.

Another important question to consider is whether the crop analysis would lead to different results than the analysis by areas, but this analysis is not possible using the available data, since the types of land in the price survey and in the RECAN technical and economical guidelines are not exactly the same. When the rent rates survey encompasses a longer period of time, such a study can be performed and the previously mentioned analysis can be reconsidered.

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