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The research aim to test the information collected through the Italian FADN survey to analyze the characteristics of Italian land market and was referred to accounting year 2009. The value of land is estimated according to the criterion of the most probable market value and is related to an administrative area and a quality culture. Given the similarity of information obtained, the results have been compared with data of the INEA survey on Land Market published on the website Institute. The data recorded by the FADN are therefore suitable for the analysis of the characteristics of the Italian agricultural land market and the good quality of the information collected, regardless of the checks carried out, is also an evidence of the rigor with which FADN data collections are performed.

Introduction

INEA has recently concluded a study aimed at verifying the compliance of FADN data with an examination of Italian agricultural land market characteristics. Although the results of the study, still in the course of publication under the title *Il valore della terra – Un contributo alla conoscenza del mercato italiano dei terreni agricoli attraverso i dati della RICA* (Land Value – A contribution to Italian agricultural land market knowledge by using FADN data), are fully satisfactory, the occurrence of certain circumstances has suggested a need for the study itself to be repeated. First of all, this refers to the fact that the study in question was conducted with reference to the 2007 fiscal year and therefore directly coincided with the substitution of accounting method supporting the FADN. The testing of data compliance for the purposes of the aforementioned study and revealed by the new accounting method, therefore, is considered to be more useful than ever. Furthermore, the comparative examination of the study results with the data produced by INEA Land Market survey has highlighted variability in the examined data which could be ascribed in part to the use of different references to crops and territories in the

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sources quoted, as well as the ways of analysing the results obtained. Thus there is scope for these aspects of the study to be perfected.

The goals of this paper are those cited above, i.e. testing of the data revealed by Gaia (this is the name of INEA new accounting method) in order to characterise the Italian agricultural land market and, at the same time, refine the methodology of both processing the available data and analysing the results of the study. To attain these goals, as will be shown, information corresponding to the fiscal year 2009 has been used and references to geographical areas used in the study have been redefined.

1. Notes on the methodology

As has already been stated, this paper is a further development of a recent study conducted by INEA using FADN data which is still in the course of publication; for detail of the methodology used, reference should be made to that study. In order to facilitate correct understanding of the work carried out, however, some information on the characteristics of the variable examined, the choice of territorial and crop references and the methods for selecting and processing the available data is useful.

The variable examined – It is the value of agricultural land, which is, in this case, related to the value of the bare land[1] and it is estimated according to the criterion of the most probable market value. The estimation is been carried out subject to accurate attribution of crop typology of the farmlands in order to identify the portions of land within which the conditions of homogeneity occur with regard to the variables which affect the value of the land itself.

The choice of territorial and crop references – A significant phase of the study was the definition of territorial and crop references by which to arrange the available data. The criteria for the identification of these references were the statistical robustness of the data to be produced and also its usability. This resulted in identifying territorial references in the altimetric provincial areas defined on the basis of ISTAT altimetry and the adoption of the following crop typologies: dry arable crop, irrigated arable crop, orchard, vineyard, olive grove, pasture and woodland. It should be emphasised that both the territorial and crop references can be recognised macroscopically, that is a considerable advantage.

In the study cited in the introduction, the territorial references (macro-areas) were identified using ISTAT altimetry, which is defined only on the basis of height above sea level but not distance from the sea. In the phase dedicated to the comparative analysis of the results obtained, this suggested the hypothesis that the differences found with respect to data from other sources were to be ascribed to the differences in the identification of the macro-areas. Therefore, in carrying out the study reported in this paper, it was considered appropriate to use ISTAT altim-

[1] This happens because FADN data are accounting data. The values of the stands, therefore, if present, are recorded separately to be subjected to amortisation.

etry as defined also on the basis of distance from the sea, in order to obtain the same territorial references as the INEA Land Market survey and to be able to develop a more accurate comparative examination of the results of the study.

The aforementioned crop characteristics on the other hand have been obtained from aggregation of the land typology used by Gaia, as shown in Table 1.

Table 1. Correspondence between crop aggregation and GAIA land typology.

crop aggregation			GAIA land typology	
code	description	irrigated area	code	description
1	Irrigated arable crop	0	01	field crop
			23	horticulture and flowers
2	Dry arable crop	1	01	field crop
			23	horticulture and flowers
3	Orchards		06	Orchard
			07	Citrus Orchard
4	Vineyard		09	Vineyard
5	Olive grove		08	Olive grove
6	Pasture and meadows		03	Meadows
			04	Pasture
7	Woodland		14	Woodland

To distinguish the macro-crop of dry arable crops from irrigated arable crops, the dichotomous variable "irrigated area" was considered, which identifies the extent to which a piece of land can be irrigated.

The possible associations between macro-area and macro-crop represent the post-stratification criterion of the field of observation of the analysis.

The selection and processing method of available data – In consideration of the limited representativeness of the FADN sample for the variable in question, the calculation of average values was carried out using the simple arithmetic mean instead of a weighted mean. In detail, the main figures of the study are as follows. In the Gaia archives for the year 2009 there are 49,616 registrations corresponding to farm lands. Nevertheless, considering just the lands coming under the prearranged classification, i.e. those related to the selected macro-crops, a total of 35,011 observations were obtained. Furthermore, it was decided not to make use of all the available observations of the sample, but to use the panel of the sample corresponding to the years 2008 and 2009, i.e. a subsample which takes into consideration a number of observations that are present in both years. Indeed a date which is confirmed in two consecutive years gives a greater guarantee of accuracy. In this way a panel was obtained composed of 29,205 observations common to both of the samples. Finally, only the post stratification strata which contained

observations corresponding to at least 5 different farms were considered, obtaining a final sample of 27,468 observations for a total of 9,994 farms and 863 stata (intersections between macro-areas and macro-crops).

2. Presentation of results of the study

The valuation of the average values of soils by crop typology (including woodland) and geographical zone uses the Gaia archive data on the 2009. Since it has not been possible to adopt a method which allows for statistical representativeness of averages calculated, the single indication of the "reliability" of the estimation is the frequency of observations employed for the purposes of the estimation itself. Indeed, although the FADN sample is a random sample based on a sample design which allows for calculation of weights to be assigned to each farm for the subsequent extension of collected data to the aggregate of farms in the field of observation, these weights cannot be used here for two reasons: the statistic unit in the FADN survey is the farm and not the type of soil, and the type and value of soil do not constitute strategic variables in the sample design. For this reason in the following tables the number of observations used for the estimation is also provided, next to the column of value. This information enables assessment of the reliability of the estimation; the higher the number of observations, the higher the probability that the assessed value is equal to the real value (the decision was made not to show the averages if they were calculated on the basis of less than five farms observation). Table 2 shows the values by region and altimetric zone. Details at province level are also available on the INEA website.

As regards details by macro-crop, dry cropland varies from a maximum of € 159,547 per hectare for the Campania plain to a minimum of € 4,875 in Sardinia for inland mountain; irrigated cropland varies from € 164,166 for coastal hill in Liguria to € 6,504 for inland hill in Calabria; orchard varies from € 190,427 in Trentino (inland mountain) to € 10,232 in Tuscany for inland mountain; vineyard varies from € 189,166 in Trentino to € 9,516 in Basilicata for inland mountain; olive grove varies from € 57,074 in Veneto plain to € 8,466 in Basilicata for inland mountain; pastureland varies from € 47,646 in Veneto plain to € 2,023 in Calabria for inland hill; and finally, woodland varies from € 24,157 in Veneto plain to € 1,057 in Alto Adige (inland mountain).

Soil value varies within each region depending on the altimetric zone of the municipality in which the farm which owns the land is located (nevertheless, it should be noted that there may be some cases in which the farm headquarters is located in a municipality which is not the one where the farm land is located). The main results per district are reported below.

Northern Italy

The highest values are recorded for vineyards and orchards, with particularly noteworthy average values per hectare in Trentino (around 190 thousand euros).

Table 2. The average value of soil and the number of observation by region and altimetric zones (Euros per hectare).

Region	Altimetric zone	Dry arable crop		Irrigated arable crop		Orchards		Vineyard		Olive grove		Pasture and meadows		Woodland	
		Value	n	Value	n	Value	n	Value	n	Value	n	Value	n	Value	n
Valle D'Aosta	inland mountain			34.510	9	46.422	48	59.557	63			18.168	821	3.010	150
Piemonte	inland mountain	19.760	19	29.444	43	18.749	42					9.083	178	6.924	43
	inland hill	12.566	340	17.257	105	20.954	170	39.987	333			11.153	259	5.501	165
	plain	21.637	161	28.163	541	32.735	86	73.989	20			24.637	173	14.692	23
Lombardia	inland mountain	69.910	11			29.042	17	34.832	19			23.459	73	23.949	21
	inland hill	45.400	39	57.880	57	57.074	9	68.503	41			37.843	30	13.060	24
	plain	54.142	80	52.457	585	55.640	11	57.728	6			34.444	68	21.699	37
Trentino	inland mountain	56.464	28	87.676	30	190.427	425	189.166	244			39.800	190	15.268	59
Alto Adige	inland mountain	7.004	100	12.060	100	30.000	248	30.043	92					1.057	157
Veneto	inland mountain	14.636	11									22.643	47	9.086	7
	inland hill	45.085	32	55.691	61	65.145	29	72.245	137	53.435	13	41.322	68	23.264	40
	plain	41.075	81	46.209	722	60.566	142	52.835	191	57.074	7	47.646	82	24.157	30
Friuli Venezia Giulia	inland mountain											12.283	45	9.486	10
	inland hill	24.539	182	26.535	50			31.733	100			15.438	83	7.002	87
	coastal hill							23.437	8			17.159	9	9.292	8
	plain	27.079	440	26.777	536	31.026	77	33.223	303	20.515	5	16.593	99	9.826	120
Liguria	inland mountain	26.617	14	55.402	62			37.548	12	32.781	35	8.987	28		
	coastal mountain			94.636	5							8.787	6		
	inland hill			152.988	30			43.033	6	35.562	41				
	coastal hill	41.626	18	164.166	433	40.797	23	35.535	30	33.296	124	11.323	14		

(Continued)

Region	Altimetric zone	Dry arable crop		Irrigated arable crop		Orchards		Vineyard		Olive grove		Pasture and meadows		Woodland	
		Value	n	Value	n	Value	n	Value	n	Value	n	Value	n	Value	n
Emilia Romagna	inland mountain	9.568	59	12.070	15	30.400	9					4.018	56	6.399	97
	inland hill	21.100	98	36.920	51	37.341	46	45.621	103	23.275	17	16.660	73	6.003	117
	coastal hill	37.571	14					59.333	6	37.714	7				
	plain	34.687	166	37.960	372	37.553	280	46.226	245			30.681	110	7.194	47
Toscana	inland mountain	26.020	71	97.048	19	10.232	16			10.123	9	6.867	8	3.135	51
	inland hill	16.188	440	43.949	123	14.020	10	36.596	297	15.089	292	3.473	93	3.660	242
	coastal hill	15.728	91	22.210	50	16.542	8	17.754	45	12.938	63			3.581	41
	plain	13.805	52	127.897	64			22.862	16	15.500	27	2.658	8		
Marche	inland mountain	10.320	91					16.757	7			2.272	26	2.889	19
	inland hill	13.910	308			12.786	16	20.198	115	16.689	104	4.249	18	6.479	49
	coastal hill	14.656	382	19.732	52	21.099	50	20.350	190	17.936	213	7.643	7	4.073	13
Umbria	inland mountain	9.140	69	14.222	7			10.712	7	8.568	8	3.777	46	2.614	25
	inland hill	12.448	381	17.296	114	14.637	12	13.411	212	11.421	261	3.764	76	2.911	208
Lazio	inland mountain	14.203	54	16.227	13					12.916	16	4.049	56	3.115	25
	inland hill	14.774	110	17.870	100	20.221	32	17.179	27	15.660	74	5.158	32	3.225	14
	coastal hill	15.562	12	28.185	40	20.961	18	22.207	13	17.711	18				
	plain	18.590	35	27.505	127	18.398	21	17.805	16	17.277	16				
Abruzzo	inland mountain	11.421	127	16.809	147			16.270	7	16.091	27	4.055	55		
	inland hill	11.117	96	17.348	22			18.934	42	16.094	87				
	coastal hill	13.074	104	17.917	103	22.861	36	19.940	203	17.431	214	6.443	10		
Molise	inland mountain	6.951	235			10.980	7	11.763	37	11.088	69	4.055	59	4.067	68
	inland hill	9.247	182	18.079	25	16.804	11	12.631	31	14.283	110	3.416	6	4.260	40
	coastal hill	14.090	35	20.131	65	19.473	24	21.847	60	18.779	72			5.596	12

(Continued)

Region	Altimetric zone	Dry arable crop		Irrigated arable crop		Orchards		Vineyard		Olive grove		Pasture and meadows		Woodland	
		Value	n	Value	n	Value	n	Value	n	Value	n	Value	n	Value	n
Campania	inland mountain	11.885	96			20.554	20	27.884	30	20.243	27	8.642	30	5.100	9
	inland hill	15.071	76	23.216	75	33.746	28	35.908	58	28.855	89	14.013	13	5.889	14
	coastal hill			143.652	17	77.524	19	80.000	6	22.825	12				
	plain	159.547	7	108.237	143	49.989	79			41.501	6				
Calabria	inland mountain	6.441	14	8.384	14					10.708	22				
	coastal mountain					20.067	15			16.143	14				
	inland hill	6.866	35	6.504	16	13.400	5			10.196	70				
	coastal hill	7.710	30	8.777	10	19.585	36	11.400	5	12.913	86	2.023	5		
	plain	6.095	24	9.708	25	18.680	14			12.749	34				
Puglia	inland mountain	11.589	48												
	inland hill	14.935	144	21.151	13	17.809	52	19.835	24	14.029	90	4.774	28	7.873	23
	coastal hill	9.394	40			12.938	8	13.495	11	12.350	54	6.585	16	7.100	5
	plain	14.487	147	17.000	130	21.860	49	19.096	174	13.207	303				
Basilicata	inland mountain	5.533	125	13.202	33	20.111	6	9.516	24	8.466	31	3.084	127	5.126	25
	inland hill	10.008	244	13.262	24	17.402	48	16.591	45	12.828	131	2.240	62	4.071	16
	plain	12.354	20	14.479	63	18.868	140	19.296	23	16.236	61	3.676	9		
Sicilia	inland mountain	8.294	74							13.691	22	3.617	56		
	inland hill	7.187	137			14.076	47	13.896	28	11.026	85	3.159	45		
	coastal hill	9.151	41	22.841	56	17.243	32	15.560	11	11.295	41	3.315	45		
	plain	8.130	10	23.577	25	19.837	38	13.798	61	11.230	40				
Sardegna	inland mountain	4.875	23									3.253	34		
	inland hill	6.515	127	12.024	30	19.500	14	11.796	20	10.676	42	3.785	112		
	coastal hill	7.591	35	13.796	27	15.800	5	11.778	9	10.667	12	3.336	33		
	plain	8.849	70	13.173	110	20.482	23	13.757	15	11.400	19	3.955	27		

Source: FADN database 2009

These values vary from 50 to 70 thousand euros for Valle d'Aosta, Piedmont, Veneto, Emilia-Romagna and Lombardy (in this last region however crops have a higher value than vineyards and orchards). The value is slightly less, around 30 thousand euros, for Alto Adige and Friuli-Venezia Giulia (in this last region cropland has a similar value to vineyards and orchards). In Liguria, however, the highest values are for irrigated cropland, which is worth around 150 thousand euros per hectare in hill areas and between 50 and 90 thousand euros in mountain areas.

Central Italy

The highest values are recorded for irrigated cropland, which is estimated in Tuscany between 100 and 120 thousand euros per hectare. Orchards and vineyards follow, with values between 20 and 40 thousand euros per hectare in Tuscany and Lazio, and 15-20 thousand euros in Marche and Umbria.

Southern Italy and islands

Also in this case the highest values are recorded for irrigated cropland, orchards and vineyards. The values vary between 15 to 20 thousand euros per hectare, with the exception of Campania, which has values equal to 100-150 thousand euros per hectare for cropland and between 50 and 80 thousand euros for vineyards and orchards.

3. Comparative examination of the results of the study

As already stated, the comparative examination between the results of the study and the values of agricultural land produced by INEA Land Market Survey was conducted using exactly the same methods already used in the corresponding study performed in 2007. More precisely, the analysis was developed as follows:

- matching of the land values of the two series of data;
- calculation of the differences between each pair of data;
- sorting of differences in classes of absolute variations and percentage variations, and examination of such differences.

Due to the perfecting of the method achieved in this study (individuation of macro-areas based on ISTAT five-level altimetry), accomplishment of the first phase was facilitated in comparison with the previous study. In this case, since the two series of data only differ from each other due to their crop references, in order to match their data it was sufficient to pair the FADN irrigated arable land with the *tout court* cropland of the Land Market survey.

It should be noted that, incidentally, the methodological structuring of the study leads to the individuation of 2.072 combinations between provincial altimetric zones (no. 296) and macro-crops (no.7). The coverage of these combina-

tions by the INEA Land Market Survey is equal to 67 %[2]. The FADN data, however, has generally a lower coverage, usually equal to 41 %[3]. As seen in the study above, however, if only the significant combinations are taken into consideration (those in which the UAA of the crop is at least 10% of the UAA of the macro-area), the level of coverage of information produced by FADN rises to more than 60% of the total.

Once the values have been matched as described above, the differences arising were sorted in the four classes of variation in value (< 5,000, between 5,000 and 25,000, between 25,000 and 50,000, > 50,000) and in the four classes of percentage variation (< 5%, between 5% and 25%, between 25% and 50%, > 50%). Table 3.a shows the frequency of the differences under examination per variation class and comparing them also with that obtained from the corresponding 2007 study.

Table 3.a. Difference between FADN and INEA Land Market Survey data.

Variation classes (€)	2007					2009				
	Variation classes (%)					Variation classes (%)				
	<5	5-25	25-50	>50	Total	<5	5-25	25-50	>50	Total
Number of cases										
<5000	71	198	110	37	416	61	210	87	27	385
5.000 - 24.999	1	42	122	142	307		60	148	126	334
25.000 - 49.999		1	9	44	54			11	24	35
> 50.000				25	25		1	3	16	20
Total	72	241	241	248	802	61	271	249	193	774
Percentage										
<5000	9	25	14	5	52	8	27	11	3	50
5.000 - 24.999		5	15	18	38		8	19	16	43
25.000 - 49.999			1	5	7			1	3	5
> 50.000				3	3				2	3
Total	9	30	30	31	100	8	35	32	25	100

Source: our elaboration on FADN and INEA Land Market Survey data.

[2] The coverage of the INEA Land Market Survey is equal to 100% of its territorial and crop references. This means that the survey in question always produces all the data. The non-coverage of the totality of combinations produced by the study in question should be ascribed solely to the fact that the study consider only one type of cropland and does not allow for the crop type "Woodland".

[3] It should be remembered that only the cases supported by a minimum number of observations equal to five is been taken into consideration.

First of all, it can be seen that the total number of observations falls from 802 in 2007 to 774 in 2009. The variation in question can probably be ascribed to a change in method aimed at obtaining information which are statistically more "robust"; this change also means that only the data coming from a minimum number of sources equal to five farms and not five farm land is considered. The examination of the percentage variations that can be deduced from the table shown, displays a shift of the differences (even if not exceptional in its extent) towards those classes being smaller in range. Compared with 2007, the second vertical class (variations included between 5% and 25%), rises from 30% to 35% of frequencies; the second horizontal class (variations included between 5,000 and 25,000 euros) rises from 38% to 43%, containing in reality also 2% of the frequencies which come from the higher class. All together, however, the two classes characterised by greater range (shaded section) fall from 10% to 8% of frequencies.

Finally, in order to estimate the differences under examination at the net of the effect caused by the method used for cropland comparison, the comparison itself was repeated excluding the land typology in question. The results obtained are reported in Table 3.b.

Tab. 3.b. Difference between FADN and INEA Land Market Survey data without arable crop.

Variation classes (€)	Variation classes (%)				
	<5	5-25	25-50	>50	Total
Number of cases					
<5000	37	117	54	21	229
5.000 - 24.999		27	89	84	200
25.000 - 49.999			5	18	23
> 50.000			3	5	8
Total	37	144	151	128	460
Percentage					
<5000	8	25	12	5	50
5.000 - 24.999		6	19	18	43
25.000 - 49.999			1	4	5
> 50.000				1	1
Total	8	31	32	28	99

Source: our elaboration on FADN and INEA Land Market Survey data

As can be seen, despite the consistent fall in number of observations (from 774 to 460), the distribution of differences between the different range classes has remained almost unchanged. The reduction in frequencies in the shaded section

was equal to only approximately 2%. Essentially this means that, unexpectedly, the method used for matching the croplands of the two series of data has provided better results than those anticipated and, therefore, that the differences found between the two series of data are to be attributed solely to the variability that the phenomenon subject of study can have also when territorial references are relatively small. From this point of view, the FADN data, normally characterised by a good number of observations, is considered sufficiently reliable. On this point, in Table 3.c all of the FADN and Land Market values are highlighted which generate the differences to be included in the larger class, and generate, for FADN values, the corresponding number of observations.

Table 3.c. Case with highest variation (> 50% and >50.000 €).

Provinces	Altimetric zone	Land typology	Value		
			FADN		INEA Land Market Survey
			observation	value	
Alessandria	plain	Vineyard	9	97.625	21.900
Trento	inland mountain	Orchards	425	190.427	96.000
Trento	inland mountain	Vineyard	244	189.166	127.200
Bolzano	inland mountain	Vineyard	92	30.043	185.300
Verona	inland hill	Vineyard	63	93.836	200.100
Treviso	inland hill	Vineyard	36	41.467	102.700
Napoli	coastal hill	Vineyard	6	80.000	23.000
Salerno	plain	Orchards	7	118.192	60.900

Source: our elaboration on FADN and INEA Land Market Survey data

In consideration of the results obtained, we deem it appropriate to affirm that data revealed through Gaia, as already demonstrated for data corresponding to the preceding years, are compliant with the examination of the Italian agricultural land market characteristics.

4. Concluding remarks

INEA has recently completed a study aimed at verifying the compliance of FADN data with Italian agricultural land market characterisation. Although the results of this study were entirely satisfactory, the occurrence of some circumstances suggested repeating the study. The study in question was carried out coinciding with a replacement of the accounting method supporting the FADN. Testing the data revealed by using the new method is considered necessary. The different ter-

ritorial and cropland references taken from different sources did not allow univocal attribution of the differences discovered between the examined data and the potential causes.

The goals of the study reported in this paper were both to test data revealed by Gaia and to refine the methods for data processing and analysis, so as to unambiguously identify the causes of data variability.

To attain the aforementioned goals, it was *sufficient and necessary* to repeat the study by using the corresponding data for the 2009 fiscal year, and using the same territorial references used by the INEA Land Market Survey in order to develop a comparative analysis of the study results with and without the croplands, which are the only crop reference which does not match between the two sources.

The results obtained, therefore, allowed for both verification of the compliance of data revealed using Gaia for the purpose of characterising the Italian agricultural land market, as well as excluding the method of data analysis from these causes. The goals of the study, therefore, are considered completely achieved.

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