

LAND CONCENTRATION CHANGES IN ROMANIA DURING 2002-2016 PERIOD

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Abstract

This paper tries to emphasize the changes in concentration of Romanian agricultural holdings and their utilized agricultural area, during 2002-2016 periods. Our research was based on census data at county level (40 counties) and utilized concentration indicators, like Herfindahl – Hirschman Index, Gini-Struck Coefficient, Gini Coefficient and Concentration Index. The results showed, in general, a low concentration, respectively an equitable distribution between counties of land and farms. However, we observed in the 2002-2016 periods a slightly increase in inequality (a higher concentration) when we analysed the number of individual agricultural holdings, the UAA of non-individual agricultural farms, the UAA of farms with under 10 ha and over 100 ha and the leased land. Also, the process of concentration had a higher growth in counties with hill and mountain landscape.

Key words: agricultural holdings, Gini coefficients.

INTRODUCTION

In Romania, in 2016, there were almost 3.45 million farms (with around 27% lower than in 2002) from which over 99% are individual agricultural holdings. The total utilized agricultural area reached 12.5 million hectares, with only 9% lower than in 2002. In the mentioned period, there were also major changes in ownership. For example, in 2002 the rented area was under 100 thousand hectares, but in 2016 reached almost 3.8 million hectares which reveals modification in concentration patterns of farms and land due to farm merging, land parcelling etc.

If we follow the evolution from 2002 to 2016 we may observe that agricultural Romanian sector went through structural changes reflected by the slightly increase of farm size, merging land processes etc. According with Stanciu (Stanciu, 2016) all this movement on agricultural and land market should converge to a higher concentration and a more specialized production. But even if the land concentration is improving, Romania is far away from reaching an optimal farm size due to a still unbalanced land use (Popescu, 2015) reflected by the “concentration of agricultural land around the farms of small and very small size” (Timofti et al., 2015) and by the large-scale

land deals (land grabbing phenomenon) (Loughrey et al., 2017).

MATERIALS AND METHODS

The aim of this paper was to quantify the changes in concentration/diversification and distribution of farms and UAA between 2002 and 2016. The research was carried out starting from the agricultural census statistical information for years 2002 and 2016, for Romanian farms. We identified 40 counties which had available data for the years mentioned and the selected variables were: number of individual agricultural holdings (NI), number of agricultural holdings with legal personality (NL), utilised agricultural area of individual agricultural holdings (UAA-NI), utilised agricultural area of agricultural holdings with legal personality (UAA-NL), leased utilised agricultural area (UAA-L) and utilised agricultural area of different holding sizes.

The concentration assessment was realized per total and per areas with similar geographical patterns. To assess the concentration we utilized various indicators like (Dona et al., 2015):

-The Herfindahl index (Herfindahl - Hirschman Index - HHI) reveals the degree of

diversification (a tendency to 1 equals a high degree of concentration and a tendency to 0 equals a high degree of diversification; “above 0.25 - highly concentrated; below 0.15 - not concentrated; between 0.15-0.25 - moderate concentration”) (Naldi et al., 2014):

$$HHI = \sum_{i=1}^n p_i^2 = \sum_{i=1}^n \frac{x_i^2}{X^2}, \text{ where } \frac{1}{n} \leq HHI \leq 1$$

$$HHI^* = \frac{HHI - \frac{1}{n}}{1 - \frac{1}{n}}, \text{ where } 0 \leq HHI^* \leq 1$$
(1)

where: HHI = Herfindahl index; HHI*= Normalized Herfindahl index

The Gini-Struck Coefficient reveals the degree of concentration (a tendency to 0 equals a low degree of concentration and a tendency to 1 equals a high degree of concentration) (Săvoiu et al., 2010):

$$GS = \sqrt{\frac{n \sum_{i=1}^n p_i^2 - 1}{n - 1}}$$
(2)

Gini Coefficient reveals the inequality level (a value next to 0 shows a perfect equality and a value next to 1 shows a perfect inequality (Shryock et al., 1980):

$$GI = \left(\sum_{i=1}^n x_i y_{i+1} \right) - \left(\sum_{i=1}^n x_{i+1} y_i \right)$$
(3)

The Gini coefficient is completed by the following Concentration Index (with values between [-1, 1]):

$$C = \frac{n}{n-1} GI$$
(4)

Actually, if Gini coefficient “represents the surface between the diagonal and the Lorenz curve relative to the total surface below the diagonal” (Dona et al., 2015), then when the concentration index is positive we have a curve below the diagonal and vice versa. In this way the graphical representation of the concentration degree through the Lorenz curve enables us to observe the tendency to equality or inequality.

RESULTS AND DISCUSSIONS

General evolution of agricultural sector

To emphasize and analyse these changes we used census data grouped by counties and we

created a database with the characteristics presented in Table 1.

Table 1. Data set - descriptive statistics (40 counties level)

	M.U.		2002	2016	%
Individual agricultural holdings (NI)	thou	Minimum	59.40	29.42	49.5
		Maximum	204.52	155.18	75.9
		Mean	116.30	84.38	72.6
Agricultural holdings with legal personality (NL)	thou	Minimum	0.31	0.28	90.3
		Maximum	0.98	1.34	136.7
		Mean	0.57	0.65	114.0
UAA-individual agricultural holdings (UAA-NI)	thou ha	Minimum	87.46	83.51	95.5
		Maximum	358.72	288.39	80.4
		Mean	191.44	172.64	90.2
UAA - Agricultural holdings with legal personality (UAA-NL)	thou ha	Minimum	48.40	30.00	62.0
		Maximum	382.22	388.33	101.6
		Mean	151.76	138.32	91.1
Lease land (UAA-L)	thou ha	Minimum	0.20	3.56	1780.0
		Maximum	8.50	329.45	3875.9
		Mean	1.56	88.75	5689.1
UAA of agricultural holdings with under 1 hectare	thou ha	Minimum	6.16	3.18	51.6
		Maximum	41.75	43.40	104.0
		Mean	18.63	15.88	85.2
UAA of agricultural holdings with 1-5 hectares	thou ha	Minimum	29.63	15.07	50.9
		Maximum	225.94	149.16	66.0
		Mean	103.85	73.51	70.8
UAA of agricultural holdings with 5-10 hectares	thou ha	Minimum	10.21	8.77	85.9
		Maximum	85.91	71.62	83.4
		Mean	35.92	32.55	90.6
UAA of agricultural holdings with 10-20 hectares	thou ha	Minimum	3.41	3.26	95.6
		Maximum	49.06	43.13	87.9
		Mean	11.73	16.62	141.7
UAA of agricultural holdings with 20-50 hectares	thou ha	Minimum	1.91	3.29	172.3
		Maximum	32.50	29.72	91.4
		Mean	6.95	13.77	198.1
UAA of agricultural holdings with 50-100 hectares	thou ha	Minimum	0.93	2.77	297.8
		Maximum	23.08	27.70	120.0
		Mean	6.34	10.43	164.5
UAA of agricultural holdings with over 100 hectares	thou ha	Minimum	46.29	30.41	65.7
		Maximum	420.91	411.63	97.8
		Mean	159.58	148.20	92.9

Source: Romanian Agricultural Census 2002 and 2016

By analysing the average data, we may observe a decrease in the numbers of individual agricultural holdings (with almost 28%) and an increase with 14% of the agricultural holdings with legal personality. This change reveals a slightly process of farming merge, but also a decrease of 10% of the utilised agricultural in both cases. The major change may be observed in the category of farms with 10-100 hectares where the UAA increased.

If we organize the data based on the geographical patterns of the counties (Toma et al., 2015), we observed the characteristics presented in Table 2.

The mountain areas present major changes, like an increase in the number of farms with 12-13%, an increase of UAA of individual agricultural holdings with 13% and an increase of the cultivated area of farms with 5-100

hectares. Also, we observe a big increase in the surface cultivated by the farms with 20-50 hectares (with 215.4%).

Table 2. Data set - descriptive statistics (geographical areas level)

	M.U.	Level	2002	2016	%
Individual agricultural holdings (NI)	thou	Plain 50-80%	205.7	170.6	82.9
		Hill 50-80%	183.6	174.1	94.9
		Mountain 50-80%	156.4	177.1	113.2
Agricultural holdings with legal personality (NL)	thou	Plain 50-80%	0.6	0.7	123.7
		Hill 50-80%	0.6	0.6	91.9
		Mountain 50-80%	0.5	0.5	111.8
UAA-individual agricultural holdings (UAA-NI)	thou ha	Plain 50-80%	205.7	170.6	82.9
		Hill 50-80%	183.6	174.1	94.9
		Mountain 50-80%	156.4	177.1	113.2
UAA - Agricultural holdings with legal personality (UAA-NL)	thou ha	Plain 50-80%	175.4	174.8	99.7
		Hill 50-80%	118.7	79.9	67.3
		Mountain 50-80%	114.0	87.2	76.4
Leased land (UAA-L)	thou ha	Plain 50-80%	1.8	125.7	7024.2
		Hill 50-80%	1.5	39.6	2728.7
		Mountain 50-80%	1.0	27.0	2721.5
UAA of agricultural holdings with under 1 hectare	thou ha	Plain 50-80%	20.4	17.5	85.9
		Hill 50-80%	21.0	18.7	89.1
		Mountain 50-80%	10.9	7.9	72.2
UAA of agricultural holdings with 1-5 hectares	thou ha	Plain 50-80%	108.9	73.5	67.5
		Hill 50-80%	111.4	81.0	72.7
		Mountain 50-80%	81.3	66.1	81.3
UAA of agricultural holdings with 5-10 hectares	thou ha	Plain 50-80%	34.0	26.8	78.8
		Hill 50-80%	32.6	30.4	93.4
		Mountain 50-80%	44.9	50.1	111.7
UAA of agricultural holdings with 10-20 hectares	thou ha	Plain 50-80%	11.8	13.7	116.2
		Hill 50-80%	9.2	14.2	154.3
		Mountain 50-80%	14.0	24.1	172.3
UAA of agricultural holdings with 20-50 hectares	thou ha	Plain 50-80%	8.4	13.5	161.0
		Hill 50-80%	5.5	14.6	265.3
		Mountain 50-80%	4.1	12.8	315.4
UAA of agricultural holdings with 50-100 hectares	thou ha	Plain 50-80%	7.6	11.2	147.7
		Hill 50-80%	5.7	10.1	176.0
		Mountain 50-80%	3.2	8.0	252.7
UAA of agricultural holdings with over 100 hectares	thou ha	Plain 50-80%	189.7	189.2	99.7
		Hill 50-80%	116.6	85.0	72.9
		Mountain 50-80%	112.3	88.6	78.9

Source: Romanian Agricultural Census 2002 and 2016

In the hill areas, we observe a decrease in the number of farms and UAA, but the biggest decrease is in the sector of agricultural holdings with legal personality where the utilized agricultural area was with over 33% lower. However, we have an increase of UAA for the farms with 10-100 hectares.

In the counties with plain areas we can observe an increase with almost 24% in the number of agricultural holdings with legal personality and

a major increase of the leased UAA (two times higher than in other areas). We also may observe that the commercial farms, with 20-100 hectares, had an increase of UAA with around 50-60%.

Concentration assessment of agricultural holdings

Individual agricultural holdings present a high degree of diversification ($HHI < 0.15$), respectively a low concentration (Gini coefficient under 0.19) (Table 3). The increase of GI in 2016 by 25.5% face to 2002 show a slightly tendency to concentration but the values are too low to reveal real changes.

Table 3. Concentration indicators - NI

	2002	2016	%
Herfindal	0.0276	0.0291	105.4
Normalized Herfindal	0.0027	0.0042	155.6
Gini-Struck	0.0518	0.0646	124.7
Gini Coefficient	0.1838	0.2306	125.5
Concentration Coefficient	0.1885	0.2365	125.5

Source: own calculation

The Lorenz curve enables us to observe this tendency to inequality (Figure 1) but due to the low values of concentration indexes we may affirm that the individual agricultural holdings sector is homogeneous with similar distribution of farms between counties.

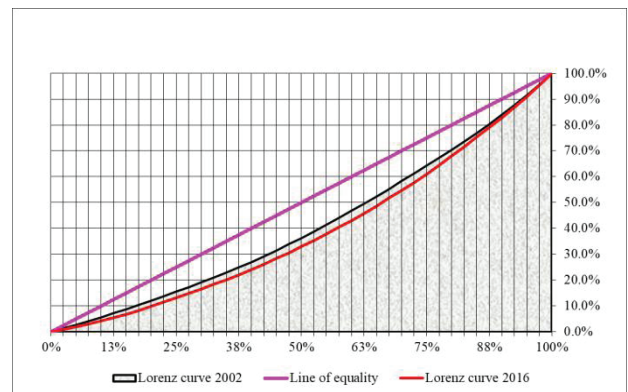


Figure 1. Lorenz curve - NI

Source: Own design

The situation is similar in the case of agricultural holdings with legal personality (Table 4).

Table 4. Concentration indicators - NL

	2002	2016	%
Herfindal	0.0273	0.0279	102.2
Normalized Herfindal	0.0024	0.0030	125.0
Gni-Struck	0.0489	0.0548	112.1
Gini Coefficient	0.1717	0.1851	107.8
Concentration Coefficient	0.1761	0.1898	107.8

Source: own calculation

Here the concentration is even lower, with GI values between 0.17-0.18 and a change of only 7.8% (Figure 2).

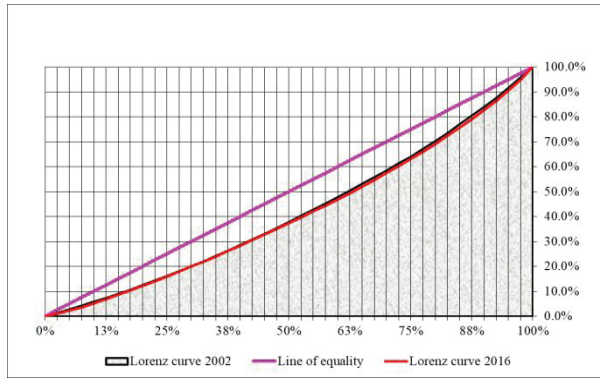


Figure 2. Lorenz curve - NL
Source: Own design

The individual agricultural holdings from plain areas present a higher concentration than in others (hill and mountain) (Table 5). With a value of GI of 0.23 in 2016, we may observe that the concentration increased with 31.5% face to 2002. However, in mountain areas exists a tendency to inequality (due to an increase of GI with 77.6% and GS with 81.6%) and an increase in concentration (an increase of HHI with 228.1%).

Table 5. Concentration indicators – NI and NL on geographical areas

Level	Concentration Indicators	NI			NL		
		2002	2016	%	2002	2016	%
Plain	Herfindal	0.0455	0.0482	105.9	0.1367	0.1372	100.4
	Normalized Herfindal	0.0040	0.0068	170.0	0.0133	0.0139	104.5
	Gni-Struck	0.0632	0.0827	130.9	0.1154	0.1178	102.1
	Gini Coefficient	0.1729	0.2273	131.5	0.1732	0.1705	98.4
	Concentration Coefficient	0.1804	0.2372	131.5	0.1980	0.1949	98.4
Hill	Herfindal	0.1334	0.1357	101.7	0.1301	0.1350	103.8
	Normalized Herfindal	0.0096	0.0123	128.1	0.0058	0.0115	198.3
	Gni-Struck	0.0979	0.1108	113.2	0.0760	0.1071	140.9
	Gini Coefficient	0.1440	0.1405	97.6	0.1138	0.1563	137.3
	Concentration Coefficient	0.1645	0.1606	97.6	0.1300	0.1787	137.5
Mountain	Herfindal	0.1306	0.1434	109.8	0.0454	0.0460	101.3
	Normalized Herfindal	0.0064	0.0210	328.1	0.0039	0.0045	115.4
	Gni-Struck	0.0798	0.1449	181.6	0.0624	0.0669	107.2
	Gini Coefficient	0.1157	0.2055	177.6	0.1678	0.1742	103.8
	Concentration Coefficient	0.1323	0.2349	177.6	0.1750	0.1818	103.9

Source: own calculation

In the sector of agricultural holdings with legal personality the situation is different. The concentration in plain and mountain areas changed very little, but in hill areas we observed an increase with 37.5%.

Concentration assessment of utilized agricultural area

The utilized area of individual agricultural holdings shows a high tendency to equality (Table 6a).

Table 6a. Concentration indicators – UAA-NI

	2002	2016	%
Herfindal	0.0273	0.0270	98.9
Normalized Herfindal	0.0024	0.0020	83.3
Gni-Struck	0.0487	0.0451	92.6
Gini Coefficient	0.1680	0.1588	94.5
Concentration Coefficient	0.1723	0.1628	94.5

Source: own calculation

Also, we may observe that the changes are very small in 2002-2016 periods (Figure 3).

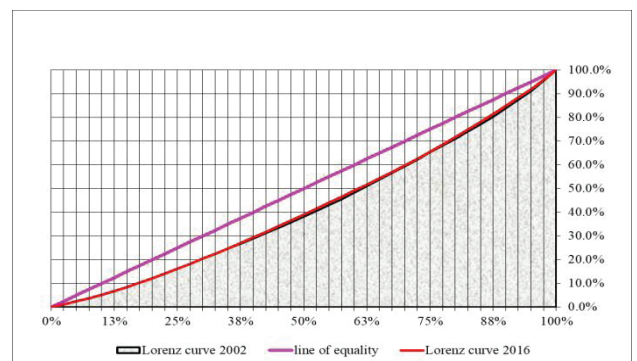


Figure 3. Lorenz curve - UAA-NI
Source: Own design

The UAA of non-individual farms, which are generally big agricultural holdings, is not so equally distributed between counties (Table 6b). The indicators show a slightly inequality tendency due to the different geographical patterns (Figure 4).

Table 6b. Concentration indicators - UAA-NL

	2002	2016	%
Herfindal	0.0309	0.0341	110.4
Normalized Herfindal	0.0060	0.0093	155.0
Gni-Struck	0.0777	0.0966	124.3
Gini Coefficient	0.2635	0.3308	125.5
Concentration Coefficient	0.2703	0.3393	125.5

Source: own calculation

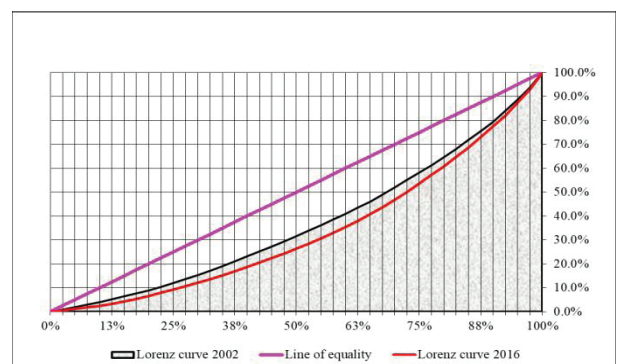


Figure 4. Lorenz curve - UAA-NL

Actually, in plain areas, in 2002, we observed a higher concentration (0.255) which demonstrate an inequality of distribution between counties with this landscape profile. But, if we analyze the 2002-2016 periods we observe an increase in concentration in hill and mountain areas (with around 40-45%), even over the level registered in plain areas (Table 7). This indicates that in the present the UAA of agricultural holdings with legal personality is more unequally distributed among counties with a preponderant hill and mountain landscape. The individual agricultural holdings show a much lower concentration and little changes in distribution between counties over time.

Table 7. Concentration indicators - UAA-NI and UAA-NL on geographical areas

Level	Concentration Indicators	UAA-NI			UAA-NL		
		2002	2016	%	2002	2016	%
Plain	Herfindal	0.0456	0.0457	100.2	0.0504	0.0511	101.4
	Normalized Herfindal	0.0041	0.0042	102.4	0.0091	0.0099	108.8
	Gni-Struck	0.0643	0.0646	100.5	0.0957	0.0993	103.8
	Gini Coefficient	0.1727	0.1731	100.2	0.2555	0.2656	104.0
	Concentration Coefficient	0.1802	0.1807	100.3	0.2666	0.2772	104.0
Hill	Herfindal	0.1312	0.1296	98.8	0.1421	0.1600	112.6
	Normalized Herfindal	0.0071	0.0052	73.2	0.0196	0.0400	204.1
	Gni-Struck	0.0843	0.0724	85.9	0.1399	0.1999	142.9
	Gini Coefficient	0.1228	0.1034	84.2	0.2024	0.2833	140.0
	Concentration Coefficient	0.1403	0.1182	84.2	0.2314	0.3238	139.9
Mountain	Herfindal	0.1317	0.1320	100.2	0.1401	0.1567	111.8
	Normalized Herfindal	0.0077	0.0080	103.9	0.0172	0.0362	210.5
	Gni-Struck	0.0877	0.0896	102.2	0.1313	0.1903	144.9
	Gini Coefficient	0.1260	0.1316	104.4	0.1908	0.2768	145.1
	Concentration Coefficient	0.1440	0.1504	104.4	0.2181	0.3163	145.0

Source: own calculation

Like we presented in the first part of the paper, the leased land had a strong growth in all counties, but especially in the plain areas. The Gini index is over 0.4 in both years and its increasing (with 6.6%) which reveals a tendency to inequity (Table 8).

Table 8. Concentration indicators – leased land

	2002	2016	%
Herfindal	0.0463	0.0425	91.8
Normalized Herfindal	0.0218	0.0180	82.6
Gni-Struck	0.1477	0.1341	90.8
Gini Coefficient	0.4197	0.4472	106.6
Concentration Coefficient	0.4304	0.4586	106.6

Source: own calculation

Concentration assessment of UAA by size of agricultural holdings

In 2016, the lowest level of land inequality (low concentration) was found in the category of farms with 1-5 ha (0.253) and the highest level (0.349) was found in the category of

farms under 1 ha (Table 9). Face with 2002 we observe a more inequitable distribution between counties in the category of farms with under 10 ha and over 100 ha. But in the category of farms with 10-100 ha the distribution of UAA was more equitable. This means that we have a real change in structure of UAA. The categories of farms under 10 ha and over 100 ha are going through a decreasing process and the commercial farms (with 10-100 ha) are developing in each county.

Table 9. Concentration indicators - UAA-NI and UAA-NL on geographical areas

Level	Concentration Indicators	Individual agricultural holdings		
		2002	2016	%
UAA of agricultural holdings with under 1 hectare	Herfindal	0.0313	0.0350	111.8
	Normalized Herfindal	0.0065	0.0102	156.9
	Gni-Struck	0.0804	0.1011	125.7
	Gini Coefficient	0.2763	0.3490	126.3
	Concentration Coefficient	0.2834	0.3579	126.3
UAA of agricultural holdings with 1-5 hectares	Herfindal	0.0290	0.0300	103.4
	Normalized Herfindal	0.0041	0.0051	124.4
	Gni-Struck	0.0643	0.0717	111.5
	Gini Coefficient	0.2227	0.2525	113.4
	Concentration Coefficient	0.2284	0.2590	113.4
UAA of agricultural holdings with 5-10 hectares	Herfindal	0.0314	0.0328	104.5
	Normalized Herfindal	0.0066	0.0080	121.2
	Gni-Struck	0.0811	0.0894	110.2
	Gini Coefficient	0.2750	0.3122	113.5
	Concentration Coefficient	0.2821	0.3202	113.5
UAA of agricultural holdings with 10-20 hectares	Herfindal	0.0393	0.0331	84.2
	Normalized Herfindal	0.0147	0.0083	56.5
	Gni-Struck	0.1211	0.0910	75.1
	Gini Coefficient	0.3566	0.3103	87.0
	Concentration Coefficient	0.3658	0.3183	87.0
UAA of agricultural holdings with 20-50 hectares	Herfindal	0.0390	0.0305	78.2
	Normalized Herfindal	0.0144	0.0056	38.9
	Gni-Struck	0.1199	0.0751	62.6
	Gini Coefficient	0.3334	0.2641	79.2
	Concentration Coefficient	0.3420	0.2709	79.2
UAA of agricultural holdings with 50-100 hectares	Herfindal	0.0355	0.0326	91.8
	Normalized Herfindal	0.0107	0.0078	72.9
	Gni-Struck	0.1037	0.0881	85.0
	Gini Coefficient	0.3286	0.2956	90.0
	Concentration Coefficient	0.3370	0.3032	90.0
UAA of agricultural holdings with over 100 hectares	Herfindal	0.0325	0.0352	108.3
	Normalized Herfindal	0.0077	0.0105	136.4
	Gni-Struck	0.0877	0.1025	116.9
	Gini Coefficient	0.2898	0.3454	119.2
	Concentration Coefficient	0.2972	0.3542	119.2

Source: own calculation

Actually, if we analyze these results in correlation with the data from Table 2 we can see that the biggest modifications are in hill and mountain areas. In the counties with hill landscape the UAA increased with 50-80% in the sector of farms with 10-20 ha and 50-100 ha. In counties with mountain landscape the UAA increased with over 70% in the sector of

farms with 10-20 ha and with around 153% in the sector of farms with 50-100 ha. The biggest growth is in the sector of farms with 20-50 ha. Here, we have an increase with 61% in plain areas, 165% in hill areas and 215% in mountain areas.

CONCLUSIONS

Our research shows a low concentration of farm and land, but also emphasize the structural change due to the exit of farms with under 5 ha, a split of farms with over 100 ha and a merging process especially in the sector of farms with 20-50 ha. The changes are small, with little impact in the distribution of farms and UAA between counties (concentration indexes), but they show a slightly tendency towards inequality. These facts reveal different patterns of change in Romanian counties due to different degree of development in the last decades.

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