ECONOMIC AND SOCIAL EFFECTS OF LAND FRAGMENTATION ON BULGARIAN AGRICULTURE

[1]Stela AtanasovaTodorova, [2]Dimka Lulcheva

[1]Department of Agricultural Economics, University of Agriculture, Bulgaria, E-mail: stela@au-plovdiv.bg

[2]Department of Management and Marketing, University of Agriculture, Bulgaria

Manuscript received: October 25, 2005; Reviewed: November 3, 2005; Accepted for publication: November 3, 2005

ABSTRACT

Historically proven fact is that land fragmentation is a logical consequence of each land reform. The ownership restitution of land on small noncontiguous and spatially dispersed parcels prevents establishing of viable and profitable farms and hence becomes a holdback to an efficient agriculture. This negative effect becomes increasingly stronger. The small land parcels impede applying of new technologies and production models, as well as the labor and machines' efficient use. The scattered parcels make difficult the planned operation of land. Notwithstanding the land reform in Bulgaria is already completed, the resulting fragmentation continues to exist and exerts negative impact on the rural regions' sustainable development. Improvement of these areas' means of living is connected with the efficiency of resource use, which may be achieved through land consolidation and territorial planning.

The purpose of this study is to analyze the economic and social effects of fragmentation on agriculture in Bulgaria.

KEY WORDS: land reform, land fragmentation, rural regions, cooperative.

INTRODUCTION

With enforcing the Land Law in Bulgaria, the private ownership became prevailing form, representing 86.24 % of the agricultural and 98.33 % of the arable land in the country. Private farms emerge as a main result of the ownership restitution of land and are predominant organization form.

According to data of the Ministry of Agriculture and Forestry, the number of farms owned by physical persons is 763500 in 2000/2001. Their share is 99 % of the farms' total number but they cultivate only 26 % of the country's agricultural land. The average size of these farms is 1.2 ha. During the same period, in the country there are 2400 legal entities and individual firms that run about 23 % of the land. The production cooperatives are 2900. Their share is just about 0.40 % of the total number of farms, however they cultivate 51 % of the land. Their average size is 599.5 ha. Nearly 95 % of the agricultural land is being rented and only 5 % of it cultivated by its owners.

The lack of balance regarding labor, land and capital in most of the farms determines an extremely low productivity. The technical and economic changes in these farms are insignificant, mainly due to the high share of farm labor, which makes production investments being unnecessary.

The female workers in agriculture are nearly 1/3 of all the employed in this sector. The workers aged below 35 are 12.5 %, while those who are 64 years old and above are 28 %. Most of the male and female workers employed in agriculture are in a pension or pre-pension age.

Another negative result of the ownership restitution of land is that the mechanized activities sharply declined. The land fragmentation reduces the effectiveness of mechanization. The small farms even come back to draft animals and are distinguished for using of manual labor mainly.

The form of the land privatization put many obstacles to irrigation. It affected the usage and integrity of irrigation and the land melioration systems. The high fragmentation levels cause limiting access to the irrigation networks.

After 1989, the usage of lands provided with melioration fittings has drastically declined. Besides fragmentation, the crop schedule is another reason for the decreased level in using the irrigation installations. During the last years, 60 % of the irrigated land is under grain crops that are not being irrigated.

The chemical fertilizers used in agriculture decreased more than 3.5 times in the period 1989-2001 and keep on going down. In 1989, the applied fertilizer quantity is 14.4 kg/ha and in 2001 it is 4.9 kg/ha. Considerable decline is observed also in the applied quantities of pesticides and certified seeds. All of this leads to decreasing the average crop yields and therefore to receiving of lower farm incomes.

The main question we try to answer is "How does land fragmentation affect the production efficiency in Bulgarian agriculture"?

MATERIALS AND METHODS

The purpose of this study is to analyze the economic and social effect of the ownership restitution of land and resulting fragmentation on the cooperatives' production activity and social functions, as well as to identify the opportunities for solving these problems. The object of study is the largest cooperative in Plovdiv region that had 4800 ha of arable land located on the territory of only one settlement. The study includes a five-year period -1996-2000. In 2002, the cooperative discontinues the production activity because of unpaid duties to its workers and the State.

The study tries to answer the following questions:

1. How does fragmentation of land proceeding from its restitution in real limits exert influence on the "Maritza" cooperative's production structure?

2. How do the cooperative's structure and economic parameters change over the time?

3. What is the impact of land fragmentation on the rural region's sustainable development, particularly on the farm incomes and employment?

4. What methods of consolidation the agricultural producers in this region try to apply?

It should be mentioned that in the studied settlement, besides the cooperative there are also private farms, which have emerged in result of the land restitution. Regarding the farm size, predominant are the small farms with an average size of 2 ha.

The production cooperative "Maritza" is located 18 kilometers away from Plovdiv - a large industrial and agricultural center. In 1996, the cooperative had more than 2000 member cooperators. Besides production activity, the cooperative has also carried out significant social activity. The cooperators were provided with bread, milk, cheese, vegetable oil, rice, apples and other products. They received these products at prices considerably lower than the market ones. The cooperative had also a holiday house and canteen, where the cooperators received food at considerably reduced prices.

The methods used in the study are: interview with the president of the cooperative who has been on active duty during the studied period, own observations on the cooperative's activity, methods of economic analysis,

the Januszevski's fragmentation index and book-keeping documents of the cooperative. There are six parameters of evaluating the level of fragmentation: farm size, plot number, plot size, plot shape, spatial distribution of plots and size distribution of plots. Four of these parameters were used to assess the fragmentation level in our case.

The index used to evaluate the fragmentation extent in the "Maritza" cooperative is developed by Januszewski (1946). This index divides the square root of the total farm area by the sum of the square roots of the plot sizes. It varies within the range 0 - 1, with a value of 1 indicating a farm operation with one contiguous parcel. The Januszewski's index exhibits three properties: a) fragmentation increases (or the value of the index decreases) when the number of plots increases; 2) fragmentation increases when the range of the plot sizes is small and 3) fragmentation decreases when the large plots' area increases and that of small plots decreases (Burton and King 1982). The index (K) with (a) representing parcel size is defined as:

$$K = \frac{\sqrt{\sum a}}{\sum \sqrt{a}}$$

The table gives data about the size and structure of the cooperative's area under crops. It can be seen from the table that this area continuously decreases. In 2000 it has been more than twice smaller compared to that in 1996. On one side this is due to the land restitution, as result of which many landowners left the cooperative and a process started of fragmentation of its land. On the other side, the decrease in the cooperative's area results from the changes in its production structure. The areas under vegetables and permanent crops decreased owing to the above mentioned factors and lack of motivation to grow fruit and vegetables because of their low profitability and difficulties in marketing. Growing of these crops on fragmented parcels is often connected with increased labor and transportation cost and losses of produce. This is due to different reasons, such as inexpedient and impeded carrying out of the agricultural activities, impossibility to guard the produce because of the plots' remoteness, etc.

Data presented in tables 1 and 2 show that during the fiscal 1995/96 year, the cooperative has 3837.7 ha arable land, consisting of 90 parcels with an average parcel size of 42.6 ha. The smallest parcel size is 18 ha and the biggest one - 140 ha. The parcels are large and according to the index of Januszevski the land is found considerably consolidated. Table 2 gives the km distances to the nearest and most distant parcel, which almost do not change during the studied period.

In 1997, the number of the parcels keeps from moving but their average size (38.9 ha) decreases insignificantly because 28 ha of fields and 200 ha of permanent crops go out of the cooperative. The fragmentation index remains the same (0.11). During the next year (1998), the parcel number reaches 3400, however the average parcel size sharply declines and becomes 1.03 ha or it declines 41.3 times. The fragmentation index decreases 5.5 times, which being attended with a higher plot number and lower average plot size indicates that the fragmentation level of the cooperative's land has considerably increased.

During the last two years (1999 and 2000), the plot number goes down, which is connected with a decrease in the cooperative's total area (in 2000 it cultivates 1775.3 ha). The fragmentation index remains within 0.02. The average plot size is also considerably decreased and is close to that of 1998.

Further, we are going to examine how the fragmentation index influences the yields, costs and net income per a hectare of area.

As can be seen from the table, there is a decrease in

Table 1: Size and structure of the Maritza cooperative's cropped area (hectares)

Crops	Years					Dynamics				
	1996	1997	1998	1999	2000	1996	1997	1998	1999	2000
1. Grain crops	2304,4	2092,5	2325,0	2024,4	1538,4	100,0	90,8	100,9	87,8	66,8
2. Industrial crops	335,6	200,0	75,0	98,5	95,6	100,0	59,6	22,4	29,4	28,5
3. Vegetable crops	190,0	44,8	70,0	56,0	20,0	100,0	23,6	36,8	29,5	10,5
4. Fodder crops	543,6	552,0	545,0	344,0	18,3	100,0	101,4	100,3	63,3	3,4
5. Perennial plants	464,1	514,8	548,0	548,0	103,0	100,0	110,9	118,1	118,1	22,2
Total	3837,7	3504,1	3488,0	3070,9	1775,3	100,0	91,3	90,9	80,0	46,3

Table 2. Fragmentation degree by years for the period 1996-2000

Parcel size, ha	1996					1997					1998					1999					2000				
	Parcel number	Average size of parcels	Index of Jamuszevski	Average distance to the nearest parcel	Parcel number	Average size of parcels	Index of Jamuszevski	Average distance to the nearest parcel	Parcel number	Average size of parcels	Index of Jamuszevski	Average distance to the farthest parcel	Average-rage distance to the nearest parcel	Parcel number	Ave-rage size of parcels	Index of Jamuszevski	Average distance to the farthest parcel	Average distance to the nearest parcel	Parcel number	Ave-rage size of par cels	Index of Jamuszevski	Average distance to the farthest parcel	Average distance to the nearest parcel
< 1	-	-	-	-	-	-	-	-	55	0,56		8	0,1	400	0,51		8	0,1	300	0,54		8	0,1
1-1,5	-	-	-	-	-	-	-	-	0	1,17		11	0,1	2400	1,14		11	0,1	1300	1,18		11	0,1
1,5-3	-	-	-	-	-	-	-	-	28	2,58		8	0,1	50	2,58		8	0,1	30	2,58		8	0,1
18	1	18		3	1	1	18		00			-	-	-	-		-	-	-	-		-	-
20-30	2	24,		11	0,8	25	24,4		50			-	-	-	-		-	-	-	-		-	-
30-35	5	4		11	0,8	40	32,8		-			-	-	-	-		-	-	-	-		-	-
35-50	4	32,		2	1	6	37,3		2	1		-	-	-	-		-	-	-	-		-	-
50-100	0	8		4	0,5	15	65,4		4	0,5		-	-	-	-		-	-	-	-		-	-
120	6	37,		1	0,01	2	112,5		1	0,01		-	-	-	-		-	-	-	-		-	-
140	1	3		3	1	1	135		3	1		-	-	-	-		-	-	-	-		-	-
	5	77,																					
	2	9																					
	1	12																					
		0																					
		14																					
		0																					
Общо	9	42,	0,11	5	0,73	90	38,9	0,11	5	0,73	34	1,03	0,02	9	0,1	2850	1,08	0,0 2	9	0,1	1630	1,09	0,025	9	0,1
	0	6									00														

the average yields received from most of the crops grown during the last two years. For the grain crops this decrease begins even in 1997. During the examined period, the yields received from the vegetable crops remain relatively stable (excepting the year 2000, when a great number of crops go out of the production structure). This is due to the cooperative's established traditions and good experience in the field of vegetable growing.

Comparatively lower for the whole period remain the yields in the permanent crops, even though they have been a main income-generating source for the cooperative during the period 1996-1999. In 2000, the permanent crops' area highly declines (the fragmentation of land under these crops increases), and the yields from the vineyards and apples decrease dozens of times.

Both figures demonstrate that during the studied period the production costs increase as the size of the cooperative's utilized area decreases and fragmentation increases. This is particularly valid for the period after 1998. The highest production costs per a hectare of area are observed during the years 1999 and 2000, when the arable land declines and the number of parcels increases with 30 times (from 90 in 1996 to 3400 in 1998) and their size goes down with nearly 40 times. In 2000, the cooperative has 1775,3 hectares of land scattered on 1630 parcels. Of them 1538,4 hectares are under cereal crops.

The land fragmentation attended with destroyed irrigation system caused the cooperative to abandon the traditional for the region production structure and switch mainly to growing of grains, which allows it to pay rent in kind under concluded lease contracts.

As can be seen from the table, in 2000, the total material costs have the highest share of 69.52 % in the cooperative's total revenue. These costs represent 111.25 % of the plant-growing output's total revenue, which characterizes the branch as being unprofitable during the same year. This still more applies to the cattle-breeding sector, which has been liquidated in 2001 and the animal-breeding farm - sold to a private farmer from the State tax collection Agency because of unpaid duties to the State.

The loss incurred by the cooperative in 2000 amounts to 61000 Euro, which indicates that its production is unprofitable. Most unprofitable are the productions of tomatoes, apples, grapes, as well as the cattle-breeding sector and the cheese-production.

During the rest years (1996-1999), the cooperative has concluded its activity with making a profit, even though insignificant in 1999. This result was considerably influenced by the fact that most of the permanent crops' area (more than 360 dka) went out of the cooperative and was given back to the owners whose land comes within the massif. In this way, the cooperative remained

Table 3. Average crop yields by years (1996-2000) in kg/ha

Crops	Years					Dynamics				
	1996	1997	1998	1999	2000	1996	1997	1998	1999	2000
I. Grains										
1. Wheat	40	35	25	30	5,4	100,0	87,5	62,5	75,0	13,5
2. Barley	40	30	30	25	19,8	100,0	75,0	75,0	62,5	49,5
3. Corn	60	50	-	40	-	100,0	83,3	-	60,7	-
4. Rice	40	40	35	35	-	100,0	100,0	87,5	87,5	-
II. Industrial crops										
1. Sunflower										
III. Vegetable crops	15	15	12	10	5,4	100,0	100,0	80,0	66,7	36,0
1. Tomatoes										
2. Pepper										
3. Pepper chorbadjiiski	300	300	300	300	121	100,0	100,0	100,0	100,0	40,3
4. Eggplant	300	200	200	250	-	100,0	66,7	66,7	83,3	-
5. Water melons										
6. Potatoes	200	200	200	200	47	100,0	100,0	100,0	100,0	23,5
7. Cabbage	200	250	200	250	-	100,0	125,0	100,0	125,0	-
8. Onions	200	300	300	300	-	100,0	150,0	150,0	150,0	-
IV. Fodder crops	200	100	-	-	-	100,0	50,0	-	-	-
1. Silage corn	500	300	-	-	-	100,0	60,0	-	-	-
2. Lucerne	100	-	-	-	-	100,0	-	-	-	-
old crop										
new crop										
3. Peas - cereal mixtures	200	200	200	200	-	100,0	100,0	100,0	100,0	-
V. Perennial plants										
1.Vineyards	300	300	200	200	-	100,0	100,0	66,7	66,7	-
2. Apples	40	100	100	100	100	100,0	250,0	250,0	250,0	250,0
3. Peaches										
4. Plums	150	150	150	150	-	100,0	100,0	100,0	100,0	-
5. Cherries										
6.Morello-										
cherries	60	60	60	60	3	100,0	100,0	100,0	100,0	5,0
7. Quinces	50	80	60	60	7,9	100,0	160,0	120,0	120,0	15,8
	50	20	20	20	60	100,0	100,0	40,0	40,0	120,0
	50	45	50	80	61,6	100,0	90,0	100,0	160,0	123,2
	25	50	5	20	28,4	100,0	200,0	20,0	80,0	123,2
	25	50	5	20	28,4	100,0	200,0	20,0	80,0	123,2
	30	15	10	18	-	100,0	50,0	33,3	60,0	-

in disposal of 100 ha of permanent crops scattered in different contiguous plots. This considerably hampered the farming activities and pest and disease control, and worsened the production and economic results.

Thus, the cooperative switched to growing of few and less labor-intensive crops. However, these crops' growing faced the same problems connected with cultivation of great number of parcels, sometimes too distant from one another. In addition, these crops could not be equivalent income-generating source for the cooperative as were the perennial plants.

RESULTS AND DISCUSSION

As the survey demonstrates, land fragmentation is a problem both of the cooperative and all the farmers in the settlement. In the concrete case, the land fragmentation led to the following negative processes:

1. Worsening of the cooperative's production structure - switching from traditional for the region production structure to monocrop growing of grains, which allow "exchange of parcels" among the cooperative and the private farmers.

2. Increasing the material and labor costs separately by crops and for the cooperative in total. Fragmented land does not allow carrying out of appropriate soil cultivation and requires more time and higher consumption of fuels and grease materials, which depends on the plot size and shape.

3.The survey estimated the following profitability rates of the revenues from sales: 1996 - 0.51; 1997 - 0.46; 1998 - 0.0048; 1999 - -0.206 and for 2000 - -0.355. The negative quantities during the last two years indicate that for each unit of revenue, the cooperative incurs loss of 0.206

Table 4. Share of the material and labor cost in the total revenue' value expression for the period 1996-2000

Activities	1996		1997		1998	1999	2000	
	MC	LC	MC	LC	MC	LC	MC	LC
Total	55,64	28,83	47,80	25,98	36,13	23,87	69,52	26,47
Plant-growing	50,55	32,88	41,52	29,12	39,16	27,34	111,25	53,83
Stock-breeding	66,55	28,20	56,99	25,51	52,16	31,54	317,32	61,44
Non-agricultural activities	68,18	12,20	73,65	10,38	61,44	30,00	106,4	40,37

Figure 1
Production cost by years
(euro per a ha arable land)

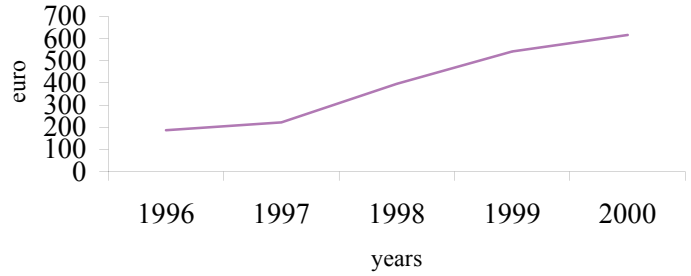


Figure 2
Cultivated area and number of parcels of the "Maritza" cooperative 1996-2000 г.

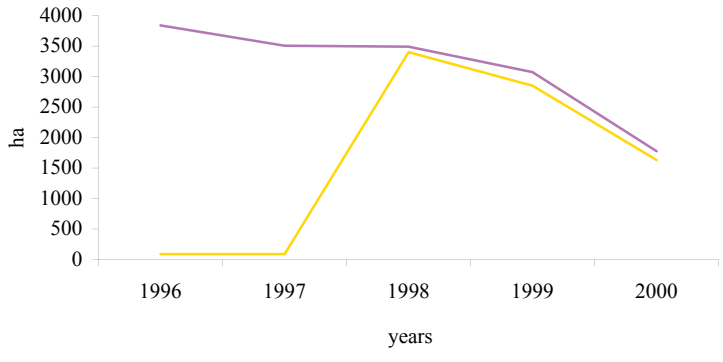
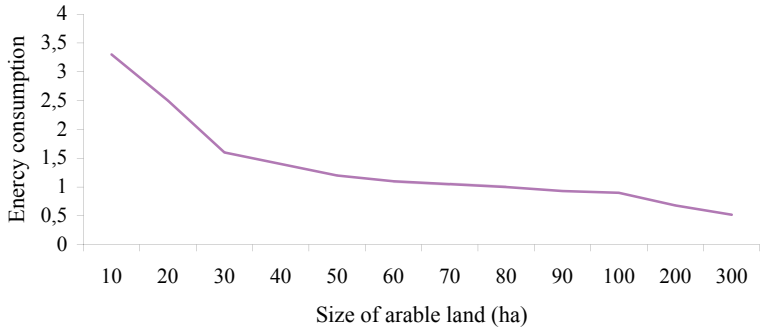


Figure 3
Alternation of fuel and grease consumption for mechanised activities for cereals depending on size of arable land



and 0.355 respectively. The profitability rates based on the cooperative's capital for the last two years are also negative: 1996 - 0.385; 1997 - 0.204; 1998 - 0.014; 1999 - -0.166 and 2000 - -2.594. This indicates that per a unit of capital, the cooperative also incurs losses.

The cooperative contributed to improving the social policy in the given settlement. It provided jobs, training to its workers, mechanized services to the small farmers, who had no machines, maintained and improved the infrastructure in the rural region. As mentioned above, the cooperative supplied the member cooperators with food products at lower price. In other words, the cooperative replaced the State after its withdrawing caused by lacking of appropriate rural regions' policy and the economic conditions and different restrictions.

Land fragmentation is already cited as being problem both for the cooperative and all the private farmers. That is why, they all use different methods of land consolidation. The main reason for that is the economic survival of these structures. The most wide-used way of overcoming the fragmentation is land lease, which however is not easy to apply where the parcels are small and non-contiguous. Very often, the parcel lies in the middle of the field and therefore it can not be taken or granted on lease.

For the above mentioned reasons, the most appropriate and wide-used way of overcoming the problem is the so-called "parcel exchange" among the individual farmers or among the farmers and the cooperative. At this stage, this is the only way the cooperative may supply itself with consolidated land.

In conclusion, we may say that the land fragmentation and growing the crops on dispersed parcels is connected with lowering of their productivity, increasing the material and labor cost, increased transportation cost and time, loss of land for marking the boundaries and access to roads, difficult access to some of the parcels, limited access to the irrigation network and lower efficiency of the mechanized activities.

The advantages of land fragmentation in this region refer to lowering the risk involved through growing of different crops on many parcels, each of them with different characteristics. The region's natural environment and microclimate allow higher production diversification with growing of great variety of fruit, vegetables, grain and industrial crops. In this way, the land fragmentation emerges as a mechanism, which will allow the farmers to make the best use of this diversity. Regarding the crop rotation, the fragmentation allows the farmers to grow variety of crops with different ripening time, so as they to may concentrate their labor on different plots at different time, thereby avoiding the periods of labor intension and household labor bottlenecks. Growing of different crops on different plots involves lower risk connected with the harmful weather effects. These advantages lead to reducing the cost connected with fragmentation and at this stage may be related rather to the private farmers than to improving the cooperative's activity.

REFERENCES:

Bonin, J. P. and D. C. Jones and L. Putterman (1993), Theoretical and Empirical Studies of Producer Co-operatives: Will Ever the Twain Meet? - Journal of Economic Literature, Vol. XXXI (September 1993), p.p. 1290-1320.

Michailov, M., Bulgarian Agriculture at the end XXth and the beginning XXst century, Agricultural Economics and Management, 1, 2001.

Stanfield, D., 1999, Creation of Land Markets in Transition Countries: Implication for the Institutions of Land Administration, working paper, no. 29, University of Wisconsin- Madison.

Todorova, S., G. Ilcheva, Situation and Problems of the Land Reform in the Plovdiv Region, Agricultural Economics and Management, 1, 1999.

National Plan for Region Development 2000-2006, Information Bulletin of Ministry of Agriculture and Forestry, 1989-2002, Sofia.