Agricultural Sustainability in Albania A Production Function Approach

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Abstract

Among several aspects concerning the concept of sustainable agriculture, a very important one is related to food security which requires maintaining constant or increasing agricultural productivity over time. Believing that the Albanian agricultural farm structure should be reorganized to put farmers in a more productive condition, thus ensuring a certain level of food security, this work analyses the existing relationship between land yields (with specific regard to cereals and vegetables) and the availability of factor inputs over the period 1970-1997. Among others, inputs such as land size and irrigation capability are particularly considered. This work concludes by highlighting that an eventual land merging policy would sustain a more productive Albanian agricultural system.

Résumé

Parmi les divers aspects relatifs au concept d'agriculture durable, il y a la notion de sécurité alimentaire, qui exige le maintien d'un niveau constant ou bien l'augmentation de la productivité agricole dans le temps. Nous estimons qu'en Albanie, la structure de l'exploitation agricole devrait être réorganisée pour que les exploitants puissent se trouver dans des conditions plus productives, assurant ainsi un niveau certain de sécurité alimentaire. C'est la raison pour laquelle dans ce travail, nous analysons la relation qui existe entre le rendement des terres (notamment, des cultures de céréales et de végétaux) et la disponibilité d'intrants pendant la période 1970-1997. De ces intrants, nous prenons en compte, en particulier, la taille des parcelles et la capacité d'irrigation. Nous en concluons en soulignant qu'une éventuelle politique de remembrement parcellaire pourrait soutenir un système agricole plus productif en Albanie.

1. Introduction

The economic literature of the 1960's and 1970's classed the agricultural sector as subordinate to the industrial one since it was thought that the modernization of the industrial sector would guarantee the majority of accumulation and growth together with a certain stability of agricultural production. However, the performances observed in several developing countries led to a further reexamination of the agricultural sector role. As some studies highlight, conditions such as erratic and unequal growth together with increases in food dependence from abroad affected a large number of developing countries (Cornia, 1985). In fact, they experienced low or negative rates in their agriculture and food output per capita with the result that the average per capita food supply was lower than the required quantities. This can also be observed in the case of Albania, which has recently come into the world's spotlight. Several studies report how the Albanian agricultural sector faces basic structural problems which still heavily affect its capabilities, although the country has largely overcome the initial difficulties of the transition process, mainly represented by land ownership acknowledgement, input market disorganization, and lack of fuel and spare parts (e.g. Morone, 1998; Hatziprokopiu et al., 1996). Nevertheless, a problem of inputs scarcity is still particularly evident in the sector in question and basically related to conditions such as low capital stock per worker, low irrigation capability, and lack of skills in the input and output.

Looking through the national statistics, it is possible to see that over the period 1996 to 1997 the agricultural gross domestic product increased at a very low rate. Furthermore, the performance of the net domestic product in per capita terms show negative signs over the same period. The table below shows data related to the agricultural sector performance over the period 1989 to 1997, highlighting the disappointing results of the sector in the final two years.

Tab. 1. *Main Agricultural Performances over the period 1989-1997*

	1989	1990	1991	1992	1993	1994	1995	1996	1997
Agr. GDP growth rate in %	- 5.4	- 17.4	- 24.0	18.5	10.4	8.3	13.2	3.0	1.0
Agr. NDP p/capita (index)*	111.0	105.6	83.4	86.1	97.6	108.2	123.3	123.1	116.2
Agr. NDP annual variation	10.2	- 5.4	- 22.2	2.7	11.5	10.6	15.1	- 0.2	- 6.9

UNDP, 1998; * data from FAO database

To comment on such a negative situation, it is often argued that Albanian agriculture should be reorganized with the aim of putting local farmers in a condition to be

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more productive. This should also help the country achieve a certain level of food security, which has not yet been completely ensured. As various authors refer, guaranteeing positive levels of production and consumption is often said to be one of the main points considered in the worldwide debate on the sustainability issue (Allen et al., 1992; Allen, 1994; Altieri, 1988; Conway, 1997; Conway and Barbier, 1990; Douglass, 1984; Francis, 1988; Lockeretz, 1988; Lynam & Herdt, 1989). One of the several key aspects of sustainable agriculture is concerned with the improvement of nutritional standards, and involves the problem of increasing or maintaining the agricultural productivity system as constant over time. As is generally known, the most broadly accepted definition of sustainable development derives from the Brundtland Commission Report and defines it as a specific form of development which "meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED, 1987: 43). In this report agriculture is also mentioned since it represents one of the most important sub-sectors of human activities which can play a basic role in pursuing sustainable development on both a local and global scale. With regard to this, the report highlights that although nowadays there is a consistent availability of agricultural resources and technologies to face the expected population growth, the global food security requires increasing food production to balance the increasing demand. It is also stressed that this aim must be achieved while retaining the essential ecological integrity of the production systems. In short, this can be considered as the cornerstone of the sustainable agriculture concept. In this same sense is the definition given by the FAO (1988) which is associated to the idea of sustainable agriculture "the management and conservation of the natural resource base and orientation of technological institutional change in such a manner as to ensure the attainment and continued satisfaction of human needs for present and future. Such sustainable development (in agriculture, forestry, and fishery sectors) conserves land, water, plant and animal genetic resources, is environmentally non-degrading, technically appropriate, economically viable and socially acceptable". From what we have just said, it may be possible to say that sustainable agriculture is a concept mainly concerned with the problem of increasing - or at least maintaining as constant - the agricultural system productivity in the long run.

On the basis of such a premise and in agreement with the idea that one of the earlier meanings of sustainable agriculture should be that of achieving appropriate levels of food security at the local level - especially in less developed countries - the present study looks at long run modes of production in the Albanian agriculture, in order to analyse the impact on some outputs of specifically considered agricultural production factors in relation to their varying availability over time. In more detail, the existing relationship between land yields and the availability of some factor inputs, mainly related to land size and irrigation, in the Albanian agriculture over the period 1970 to 1997 will be investigated. To this purpose the work will be organised as follows. Firstly, an outline of the country case study and its peculiarity with regard to the agrarian reform and the irrigation rehabilitation will be given. Secondly, the development of the theoretical and empirical framework of this work will be presented. Finally, a discussion of the empirical findings and some policy indications will follow in the two concluding sections.

2. The Albanian Agriculture Between Agrarian Reforms and Irrigation Needs

It is generally known that the population of developing or low-income countries are still predominantly rural and in many cases too dependent on food imports since they usually need external assistance to meet domestic consumption requirements. This is also the feature of our country case study. Albania lies in an area of 2,748,000 hectares (equal to 28,748 kmsq.) of which 24.4% is represented by "arable land", 14.9% by "pasture land" and 36.6% by "forests". Another residual 24.1% is represented by the general item "other uses". On the basis of this information, Albania's natural vocation for agriculture is evident.

Tab. 2. *Land Usage (in hectares) at 1996*

Type of area	Hectares	%
Total area	2,875,000	100.0
Arable land	702,000	24.4
Pasture land	428,000	14.9
Forests	1,052,000	36.6
Other uses	693,000	24.1

INSTAT, 1996

The arable land is used for growing crops such as wheat, maize and vegetables for about 577,000 ha. (82.2%). About 428,000 ha. (17.8%) are taken over with orchards. A further 45,000 and 20,000 hectares are for the cultivation of olives groves and vineyards respectively (Pugliese, 1998: 91-92).

With regard to the demographic aspect, Albania accounted 3,324,000 inhabitants in 1997, so its average population density is 115 inhabitants per kmsq. For this reason it is considered one of the most populated countries in Europe. The population is more concentrated in the coastal areas than in the inland zones. In fact, about 50.3% of the entire population lives in the coastal districts where it is possible to find a higher population density of 209,5 inhabitants per kmsq. Looking at the table below it is possible to find that more than half of the entire population (54.09% in 1997) is statistically classified as rural population, although it is possible to observe a decrease from 64.84% in 1987 to 55.98% in 1996 and 54.09% in 1997 (Vecchione, 1998). Furthermore, observing the data in 1997, about 761,000 workers, corresponding to 58.49% of the entire Albanian labour force, are employed in the agricultural sector.

While examining the contribution of the agricultural sector to the GDP, the significant role played by this economic sector in the national economy can be confirmed. As seen in the table below, the agricultural sector affects the GDP greatly, showing a contribution of 55.97% in 1997.

On the side of foreign trade, Albania is still heavily dependent on imports. Furthermore, with regard to the Albanian external assistance needs it is possible to see that the country is still an aids receiver, even if the sent aids quota shows a decreasing trend.

Under an administrative aspect, Albania changed its political-administrative assets as a consequence of the introduction of a law in 1992 which called for the establishment of ten new districts and 12 prefectural areas. Hence, under the territorial organization profile, Albania is now divided into 12 Prefectures, 36 Districts, 56 town Councils and 306 Corporations.

Tab. 3. *Population Data for the period 1989-1997 (in thousands)*

	1989	1990	1991	1992	1993	1994	1995	1996	1997
Total population	3,254*	3,286	3,297*	3,190	3,167	3,202	3,204	3,283	3,324
Rural population	2,097*	2,080	2,108*	2,024	1,852	1,857	1,868	1,838	1,798
% of tot. population	*64.44*	*63.30*	*63.94*	*63.45*	*58.48*	*57.99*	*58.30*	*55.98*	*54.09*
Tot. labour force	1,545*	1,571*	1,580*	1,580*	1,364	1,423	1,309	1,274	1,301
Pop. active in agr.	847*	857*	853*	843*	828*	812*	750	761	761
% of tot. population	*54.82*	*54.55*	*53.95*	*53.35*	*60.70*	*57.06*	*57.30*	*59.73*	*58.49*

our elaboration on data from UNDP, 1998; * data from FAO database

Tab. 4. *GDP by Main Sectors (in million of leks) for the period 1990 - 1997 with current price*

	1990	1991	1992	1993	1994	1995	1996	1997
Total GDP	16,813	16,404	50,697	125,334	184,393	229,793	280,998	337,114
Agriculture	6,762	6,967	27,491	68,484	100,755	125,435	148,318	188,698
Industry	6,252	5,260	8,548	17,362	23,112	26,943	35,137	41,782
Services	3,799	4,177	14,658	39,488	60,526	77,417	97,543	106,634
Agr. GDP (% of total)	*40.22*	*42.47*	*54.23*	*54.64*	*54.64*	*54.59*	*52.78*	*55.97*

our elaboration on data from UNDP, 1998: 86

Tab. 5. *Foreign Trade and Aids (in million of leks) for the period 1993 – 1997*

	1993	1994	1995	1996	1997
Export	12,500	13,386	18,710	22,001	21,044
Import	42,982	51,913	60,312	94,947	92,299
Changes	- 30,482	-38,527	-41,602	-72,946	- 71,255
Aids	15,355	5,105	5,835	3,113	2,722

UNDP, 1998: 90

Without entering into historic details too much, it is still important to refer to some aspects which can help understand the evolution in the agricultural organisation of the country. Between 1944 and 1945 an early agrarian reform was realised in Albania as a consequence of the introduction of a new political system which was based on a dictatorship characterised by the strictest application of Stalinist principles. This reform allowed each landowner to hold only 5 hectares of land. Thus a huge land distribution programme started and 170,000 hectares were distributed amongst 70,000 rural households, which were not previously landowners. Contemporary to the implementation of this land distribution programme, an agrarian collectivization process was started and successively developed, which led to the establishment of agricultural cooperatives and state farms. As a result, between 1975 and 1990 the structural and productive agricultural aspects were characterised by the presence of 492 agricultural cooperatives, which utilised 70% of the arable land and each with an average size varying from 550 to 1,002 hectares. Another 150 state farms which farmed 24% of the arable land and with an average size varying between 1,070 and 1,126 hectares. A further 332,000 private production units existed which utilised 6% of the arable land and with an average size of 0.12 hectares. Although the communist constitution prohibited people from organising private farms the private units were basically tolerated due to the proformances of efficiency and best contribution to the total agricultural product they showed (Pugliese, 1998).

A second agrarian reform was started in Albania after the elections in March 1991 as a result of political changes which substituted the dictatorship for a democratic system. Hence, a spontaneous decollectivization process was begun and dismantled the previous system of cooperatives. Land, livestock and other useful farming implements were distributed among the components of these cooperatives while greenhouses, cowsheds and other unshareable structures and objects were effectively destroyed. By the end of 1993, the aims of this second agrarian reform were considered achieved. In fact, about 80% of the former state farms and 93% of the former cooperatives' lands were distributed. As a result of this land distribution process, the agricultural productive system of Albania was characterized by farms with small- sized lands and composed of more than one piece of cropping area, which were often far from one another. An analysis carried out between 1993 and 1994 found that the farming area was about 1.2 hectares and that each farm is on aver-

age composed of more than 3 pieces of land. Furthermore, the cropped areas were roughly far more than 1.5 km from each farm (Henao, 1994). At the time of writing, we can still observe that the agricultural organization has remained unchanged and very similar to the one referred to in the analysis of the period we are referring to.

With regard to altitude zones, it is found that passing from the flat to mountainous areas of Albania the percentage of farms which have an average size between 0.5 and 1.5 hectares tends to decrease, even though they are still predominant. However, the average farming area per individual is found to be between 0.08 and 0.43 hectares and between 0.20 and 0.28 hectares per farmer family.

Tab. 6. *Farming Areas, Number of Land Pieces and Distances per Prefectures as at the year 1994*

Pretectures	Average of farming area (in ha.)	No. of land pieces	Distance of land pieces from farmer's house (in metres)			Average distance of farms from agricultural markets (in km.)	
			averge	min	max	products	inputs
Berat	1.08	3.7	1,433	435.67	3,556	10	12.3
Diber	0.885	3.5	1,281	346	3,600	8	8
Durres	1.125	3	1,737	130.5	4,591.5	6	5
Elbasan	1.03	3	862.5	20	2,601.5	12	12.5
Fier	2.1	3	3,142	677.5	6,250	10	13.5
Gjirokaster	1.7	4	2,786.3	715	5,285.7	5.7	10.7
Korce	1.14	5	1,165	350	4,200	16	10
Kukes	0.4	4	854	333	2,343	33	33
Lezh	1.27	3	278.7	69.7	404.3	13.7	26.3
Shkoder	1.32	2.7	461	15	2,105.3	15	14.7
Tirane	1.18	3	1,418	327.5	3,752	5	5.5
Vlore	1.28	5	1,759.5	575	4,912	34.5	36
Averages	*1.209*	*3.57*	*1,431.5*	-	-	*14.7*	*15.625*

Henao, 1994

From what we have just shown, it can be easily perceived that such an organization of the agricultural sector of the country negatively affects the technical and economic efficiency of the farms. Indeed, evident are the problems linked to, for instance, time wasted in order to go from one field to another, difficulties of efficient mechanization for cropped areas of a small size, and difficulties in working and keeping watch over the land.

Another problem heavily affected the Albanian agriculture. Since the distribution of the arable land in the early 1990s was not made on the basis of any technical plan, the water resource was used improperly in the irrigable areas with the consequence that the irrigation system was seriously damaged very quickly. Hence, the agricultural sector suffered from the problem of scarcity and in many cases of the lack of water supplies for quite a long time, although the country has well-developed ground and underground water resources.[1] Actually, the problem was related to water distribution for irrigation purposes which still today has not yet been completely solved. Such a situation represented one of the main emergencies for the Albanian reconstruction since it played a damaging role against the health of its whole economy. Therefore, Albania soon needed interventions to organize the distribution of water supplies for agricultural purposes in order to allow farmers to increase the production of their crops. After all, there is general agreement in observing that improvements in water supplies in agriculture can yield increases in agricultural output, can stabilize agricultural returns, and promise to reduce unemployment and to stimulate economic development in rural regions (Young and Haveman, 1985: 501).

It must be highlighted that the construction of irrigation and drainage schemes was given high priority in the

Tab. 7. *Farm Structure per Altitude Zones*

Zones	%	area on average per family	area on average per individual
Mountain			
< 0.5 ha.	53.7	0.2	0.09
0.5 – 1.5 ha.	31.5	0.9	0.17
1.5 – 2.0 ha.	8.3	1.8	0.30
> 2.0 ha.	6.5	2.7	0.41
High lands			
< 0.5 ha.	30.7	0.3	0.10
0.5 – 1.5 ha.	47.1	1.0	0.19
1.5 – 2.0 ha.	12.6	1.8	0.26
> 2.0 ha.	9.6	2.7	0.43
Hills			
< 0.5 ha.	11.8	0.3	0.13
0.5 – 1.5 ha.	44.8	1.0	0.17
1.5 – 2.0 ha.	22.4	1.8	0.33
> 2.0 ha.	21.0	2.7	0.42
Coastal lands			
< 0.5 ha.	5.0	0.3	0.12
0.5 – 1.5 ha.	42.6	1.0	0.21
1.5 – 2.0 ha.	20.3	1.8	0.31
> 2.0 ha.	32.1	2.8	0.41

INSTAT, 1996

[1] It has been observed that Albania has substantial annual rainfall even though it has dry summer seasons. In fact, less than 20% of the annual rainfall occurs in the period between April and September. The crop water deficit between June and August ranges from between 400 and 500 mm which cannot be supplied from soil moisture. As should appear evident, irrigation is necessary for summer and perennial corps. (World Bank's on line document, 1999).

dictatorship period too. Indeed, by the mid 1980s they covered about 423,000 (60.2% of the total arable land) and 430,000 hectares respectively. At the end of the 1980s when the socialist regime was in decline and with it also its economic organization, many irrigation and drainage schemes entered into a vicious circle represented by inadequate budget allocation and deferring maintenance causing system deterioration and unreliable water delivery. The situation became even worse after 1992 when a population furious with the social problems suffered between 1990 and 1992 destroyed everything which could be classed as public property. As a result and with specific regard to the irrigable area a decrease from 423,000 hectares in 1989 to 340,000 in 1994 was observable. Thanks to the large foreign assistance Albania received after its conversion to a democratic system, several projects for the development of the various productive sectors were started. Of course, agriculture was recognised as one of the most important economic sectors to which high priority should be given. However, for the above-referred reasons, the irrigation sub-sector received more attention than others.

Therefore, the Irrigation Rehabilitation Project (IRP) represented one of the most important development projects in Albania. It cost 44.5 million dollars and was started by the Albanian Government in December 1994 with the financial support of the World Bank and co-financed by a number of international cooperation agencies and national governments. The IRP ended in September 1999 and aimed to relate the Albanian irrigation sub-sector to the new productive structure of the agricultural sector.[2] The project concentrated attention and efforts on physically rehabilitating irrigation and drainage systems in seven Districts: Durrës, Fier, Kavajë, Krujë, Laçi, Lushnjë and Tiranë. Its implementation proceeded as shown in the following table, which illustrates the enlargement of the irrigated and the drained area achieved for each phase and District.

Tab. 8. *Results of the implementation of the IRP by implementing phase and per District (in ha.)*

Districts	phase 1 Jan. 94-Oct. 94 (irr. area)	phase 2 Oct. 94-Mar. 95 (irr. area)	phase 3 Mar. 95-Dec. 95 (irr. area)	phase 4 Jan. 96-Dec. 96		phase 5 Jan. 97-Mar. 98 (irr. area)	phase 6 Jan. 98-Sept. 99 (irr. area)	Total irrigated area	Total drained area
				(irr.)	(drain.)				
Durres	-	620	5,200	2,100	4,370	1,616	-	9,536	4,370
Fier	1,600	10,576	3,793	5,998	31,054	4,150	420	26,537	31,054
Kavaje	2,200	2,440	3,060	1,000	8,990	1,300	-	10,000	8,990
Kruje	-	3,470	3,705	-	6,323	255	1,521	8,951	6,323
Laçi	-	1,160	1,950	4,890	7,750	-	750	8,750	7,750
Lushnje	2,600	2,569	3,200	4,438	48,300	8,150	8,455	29,412	48,300
Tirane	-	220	4,230	2,236	3,081	407	-	7,093	3,081
Total	*6,400*	*21,055*	*25,138*	*20,662*	*109,868*	*15,878*	*11,146*	*100,279*	*109,868*

MAF of Albania, 1999, unpublished data

[2] A new Irrigation Rehabilitation Project (the second IRP) was started in Febrauary 1999.

3. Theoretical and Empirical Framework of the Production Function Approach

As disclosed in concluding the first section of this work, our aim is to analyse the importance of some specific production factors in relation to their varying availability between 1970 and 1997. In view of this aim the production function approach is used. Here we describe the Albanian agriculture as $Q = f(X_1, X_2,..., X_n)$ where Q is the annual output, X_i is the quantity of the i^{th} input. By relating the parameters of this function to appropriate indicators of factor availability, which will be further presented, it should be possible to identify the role of each production factor at its various stages of development. Broadly speaking if we think that the availability of agricultural production factors also depend on policy decision, the results of our analysis will help us to suggest some policy indications on the reorganization of the Albanian agriculture. In other words, in the production functions to be estimated we assume that the output quantities depend on a vector of factor inputs mainly represented by land size and irrigation capability. Furthermore, factor inputs such as land use intensity, mechanization and fertilizers consumption are also considered. In more formal terms, the production function we will estimate may be described in the following general form:

$$Qt = f(LSt, ICIt, LUIt, Mt, Ft)$$

where Qt: is the product output (in quintals) at time t;
LSt: land size (in ha.) at time t;
ICIt: irrigation capability (index) at time t;
LUIt: land use intensity (index) at time t;
Mt:mec hanization (no. of agricultural machines) at time t;
Ft: fertilizers consumption (in quintals) at time t.

With regard to the dependent variable *Qt*, the estimations we will present below are based on data for cereals and vegetables. For cereals the aggregated data between wheat and maize will be taken into consideration. As regards vegetables, the sum of vegetables and potatoes will be computed. These crops have been chosen because as can be observed by looking at the national statistics they were and still are the four main agricultural products in Albania (Instat, 1996). Furthermore, they are those most

homogeneously distributed over the entire territory since they are more or less uniformly grown throughout the Albanian farming area.

Linear and log-linear functional forms for each crop will be considered in our estimations. The rationale of this procedure lies in the fact that each of these functional forms allows different levels of interaction between the variables represented by the factor inputs. In fact, one of the assumptions made for the linear form is that of no collinearity, which means that, there is no exact linear relationship between the regressors. Summarizing, the linear form assumes constant marginal products and it has the feature to exclude any interaction between the inputs (Gujarati, 1995). It is argued that although the lack of interaction terms represents a restrictive condition, the linear functional form is much used in literature, particularly when estimates are related to wheat production and low input levels (Acharya G., 1998: 144). The log linear form assumes constant input elasticity and variable marginal products. In fact, a peculiarity of the log linear model is given by the fact that the estimated coefficients "β" of the model represent the elasticity between the output "Q" and the individual variables (Gujarati, 1995: 166). In other terms we will estimate the following functional forms:

a) linear: $$Q = \alpha + \beta 1LS + \beta 2ICI + \beta 3LUI + \beta 4M + \beta 5F + \beta 6D + \xi$$

b) log-linear: $$lnQ = \alpha + \beta 1lnLS + \beta 2lnICI + \beta 3lnLUI + \beta 4lnM + \beta 5lnF + \beta 6D + \xi$$

where the term identified by ξ is the random disturbance associated with the production function. For the econometric estimation of the above functional forms the Ordinary Least Square (OLS) methodology has been used. Time series data for the period 1970 to 1997 and for each of the considered variables are used. Agricultural outputs are measured in quintals. Land size is measured in hectares. Irrigated and arable areas are also expressed in terms of hectares and are used to form an index of "irrigation capability" which is defined here by the ratio irrigated land/arable area. A further index used in this analysis is the "land use intensity" which is given by the ratio harvested area/arable area and whose measures are always expressed in terms of hectares. The data with regard to the mechanization and fertilizer consumption are expressed in number of agricultural machines and quintals respectively. The economic priors for the econometric models utilized in carrying out this analysis are summarized as follows.

LAND SIZE. On the issue regarding the relationship between the agricultural productivity and land size, more than one view has been expressed. However, it can be generally stated that for crop production only the actual land cultivated enters the technical production function in an evaluation of returns to scale. So, solely approaching the technical input-output efficiency issue, in the agriculture of developing countries, there are strong reasons to expect approximately constant returns to scale (Berry and Cline, 1979). As proof of this, in the wide body of agricultural economic literature the majority of studies containing empirical production function estimates show this result, although different views refer to an inverse relationship existing between output and land size when the introduction of costly technological advances are taken into consideration (Berry and Cline, 1979; Giligan, 1998; Warriner, 1970). With specific regard to the Albanian agricultural case we are induced to think as follows. Albanian farmers suffer from a lack of financial resources since they are extremely poor and do not have easy access to agrarian credits. They are therefore unable to organize a capital-intensive production scheme on their small farms. As a consequence, it is not wrong to consider only the effect of the land size on agricultural productivity. Hence, a positive and approximately constant relationship between the considered agricultural outputs and land size may result, which can be mathematically expressed by $dQ/dLS \geq 0$.

IRRIGATION CAPABILITY INDEX. As already mentioned, one of the main benefits we gain from water supply improvements in agriculture is the increase in agricultural production. For this reason, a positive relationship is expected to exist between the two variables represented by agricultural outputs and the improvement in water distribution for irrigation purposes. Symbolically $dQ/dICI > 0$.

LAND USE INTENSITY INDEX. The expectation is a positive relationship between agricultural outputs and land use intensity. In fact, it is easy to recognize that a more intensive use of the land for growing a particular crop would mean an increase in the production of that considered crop, mathematically expressed by $dQ/dLUI > 0$.

MECHANIZATION. Considering the Albanian agricultural reality, which is formed by farms with an average size of 1.2 hectares, as previously reported, it seems important to refer to the economic law on diminishing marginal productivity of factor inputs while speaking about the relationship between agricultural output and mechanization. Hence, our prediction is that a negative relationship should be expected, symbolically defined by $dQ/dM < 0$.

FERTILIZER CONSUMPTION. Studies say that in the agricultural sector of developing economies it is necessary to minimize the reliance on purchased inputs. However, it is also necessary to have some bought-in inputs such as fertilizers since they represent one of the main inputs to improve production quantities (Metcalf, 1969: 82-83). As a consequence, a positive relationship is expected to exist between agricultural output and fertiliz-

er consumption, which can be mathematically expressed by $dQ/dF > 0$.

A DUMMY VARIABLE is also considered in our analysis with the aim of highlighting the agrarian structural change between the previous period of dictatorship (dummy = 0) and that of the post-agrarian reform (dummy = 1), even though the presence of a collinearity problem between the land size and the dummy variables can easily be predicted. In fact, since the setting of the dummy variable broadly follows the trend already expressed by the land size variable, its expectations should reflect what has previously been said with regard to the expectations on the land size variable. In symbols, it should be $dQ/dLS \geq 0$.

The data series considered in this analysis are at a national level and they include all levels of the pre-agrarian reform organization: state, cooperatives and private farms. The main data sources have been identified in the FAO agricultural statistic database which have been updated in some cases by using data reported in the "Statistical Yearbook of Albania" edited by the Statistical Albanian Service, although some are as yet unpublished.

4. Empirical Results of the Analysis

The parameters of the estimated production functions define long run modes of production. They take into consideration the change of factors availability over the considered period of time from 1970 to 1997. The specification of the symbols used to define the variables in the considered functions (linear and log-linear) and their empirical findings achieved through their econometric estimation – for which an SPSS software version 9.0 was used – are shown in the following two tables.

All the estimated functional forms show acceptable levels of multicollinearity with the exception of the variables represented by the land size and the dummy as expected. In fact, for each of them, looking at the variance inflation factors (VIF), it is possible to see a very low level of multicollinearity for all the estimated parameters, while very high multicollinearity levels are shown with regard to land size and dummy variables. However, as is possible to observe by looking at table ten, where the regression results are shown, the two most satisfactory versions of the achieved estimations are represented by the linear form for cereals and the log-linear one for vegetables and potatoes. To verify this, a Reset Test was run which confirmed what has just been said. For this reason, only these two versions will be taken into account in our discussion.

The linear model for cereals accepts four out of the six investigated independent variables. It has an adjusted R^2 of 0.915 and a F-statistic equal to 73.552. Both of these values suggest a good fit of the model. It is possible to observe that all the expectations on the signs of the single parameters have been respected showing a high level of significance (at 1% level) with the exception of the irrigation capability index which results significant at a level of 5%. In particular, it has to be noted that the linear form for cereals confirms the hypothesis of a positive relation between the dependent variable represented by output and the land size independent variable. In fact, the marginal effect computed by the econometric estimation shows that an increase of one hectare in the average size of the farms would produce a cereals production increase of 28,865.497 quintals, holding constant all the other influences. In the same way, the impact produced by the effect of the irrigation capability index and land use intensity variables is shown to be positive, so that a 1% increase in each of these variables produces an increasing marginal effect of 8,279,609.3 and 26,412,397 quintals respectively. The dummy variable, which has been set in order to highlight the presence of a structural change in the Albanian agriculture, also shows a high level of significance and follows the same relationship which

Ta.b 9. *Specification of the Variables used in the Econometric Models*

Q (dependent variable)	Output *(in quintals)*
LS	Land Size as national average *(in hectares)*
ICI	Irrigation Capability Index *(computed ratio)*
LUI	Land Use Intensity *(computed ratio)*
M	Mechanization *(in no. of agricultural machines)*
F	Fertilizers consumption *(in quintals)*
Dummy	Agricultural structural change

Tab. 10. *Results of the Parameter Estimations*

Variables	Linear (cereals)	Linear (vegetables + potatoes)	Log-linear (cereals)	Log-linear (vegetables + potatoes)
Constant	- 3.7E+07*	- 1.0E+07*	2.099	6.320***
	(- 12.439)	*(- 4.118)*	*(0.566)*	*(1.807)*
LS	28865.497*	10877.406*	1.169**	1.376*
	(10.465)	*(3.147)*	*(2.134)*	*(2.837)*
ICI	8279609.3**	12393397*	0.794**	- 3.7E+07*
	(2.604)	*(4.772)*	*(2.551)*	*(- 12.439)*
LUI	26412397*	-	-	-
	(10.802)			
M	-	- 334.976*	-	-
		(- 2.844)		
F	-	-	0.449*	-
			(9.580)	
Dummy	30569477*	13087041*	8.566**	9.724*
	(10.396)	*(3.742)*	*(2.334)*	*(2.960)*
Adjusted R^2	0.915	0.875	0.883	0.850
F-statistic	73.552	48.179	51.782	52.123
No.of observ.	28	28	28	28

t statistics in parenthesis; * 1% of significance level; **5% of significance level; ***10% of significance level

is between output and land size, as predicted.

The log-linear model for vegetables and potatoes also performs well, showing an adjusted R^2 of 0.850 and a F-statistic of 52.123. The model accepts just three out of the six investigated parameters. All the accepted parameters are highly significant (at a 1% level). This model also confirms our predictions on the accepted variables. In fact, the land size elasticity of the vegetables and potatoes output performs a positive relationship between the two variables performing a valuable value of 1.376. This means that a 1% increase in land size generates an increase of about 1.37% in vegetables and potatoes production. The irrigation capability index elasticity of the considered output also shows a positive relationship equal to 0.988. Even in this case, the meaning is that a 1% increase in the irrigation capability increases the vegetables and potatoes production by about 0.98%. Furthermore, the dummy variable is also found to be significant.

5. Discussion

The aspects related to the land size and irrigation capability are those on which a more detailed focus will be made, since they represent the main investigated variables which this analysis aims to refer to.

With regard to cereals, the substantial positive relationship found between output and average land size, strongly supports the fact that an increase in the average of farmland size would lead to an increase in the total cereals production. Therefore, in order to gain higher cereals production levels, a dimensional reorganization of the Albanian farms structure should not be disregarded. In fact, it would seem that the small size of Albanian farms does not verify the results obtained by other studies, where it is stated that small sized farms are more productive and efficient than larger ones. This would probably be due to the high level of land fragmentation which characterizes the Albanian agriculture and as previously observed. Regarding the policy implication, this result would strongly suggest the need to implement a land merging policy. In fact, the particularly small land size was only justifiable to satisfy the needs of the "post-emergency period" (1991-1993) when it was of major importance for the Albanian government to develop a self-consumption oriented economy to deal with the starving population. Now, farmland sizes would need to be at higher levels if a market oriented agriculture is to be formed. Higher land size levels would also give farmers the possibility to introduce agricultural machinery, which would be used in a more efficient way. A second finding of interest concerns the sensitivity of the cereals output with regard to the irrigation capability index. This result would confirm the importance of the irrigation factor input in the Albanian agriculture. The improvement of this factor input deserved and still deserves more attention since the passage from a self-consumption economy to a market oriented one requires greater irrigation capability in the agricultural fields.

Moving onto treating the log-linear functional form for vegetables and potatoes, it is possible to observe that it gives the same evidence shown by the linear form for cereals. The parameter performing the relationship between land size and vegetables and potatoes output shows a valuable land size elasticity of the output. Therefore, in this case it should also be argued that a merging land policy would put Albanian farmers in the condition to produce higher levels of vegetables and potatoes and in a more efficient way. With regard to the aspect concerning the Albanian irrigation capability for vegetables and potatoes cropping, the importance of this factor input impact should be stressed. As in the case of cereals, similar considerations should be made with regard to the vegetables and potatoes cropping concerning the irrigation capability aspect.

6. Concluding Remarks

This empirical research provides evidence that Albanian agriculture would result more productive in the case an increase in farmland size were allowed. In fact, referring to the econometric models developed in this work, the estimated parameters of agricultural factor inputs clearly show that an eventual increase of the land size would also surely and significantly increase the yield of the investigated crops. Similarly, the effect produced by the irrigation capability on both of the considered crops is particularly significant. These findings support the idea that the implementation of a land merging policy together with an enlargement of the Albanian irrigated land should produce beneficial effects on the total agricultural production. While the enlargement of irrigated land is being developed with thanks to the work of the World Bank, which at the beginning of 1999 began the second phase of the Irrigation Rehabilitation Project, this time involving different Albanian Districts, it is not possible to say the same with regard to an eventual implementation of a land merging policy by the Albanian government. Even though the improvement of agricultural performance is not only due to a reorganization of the agrarian farm structure, which only considers the land size, the need to put Albanian farmers in the condition to produce more in the sense of quantity and quality would initially require an enlargement of the farm size.[3] This would be a condition which should allow farmers to introduce more appropriate machinery to their farms with the consequence of improving the quantity and the quality of their production and opening the way to a possible industrialization of the agricultural sector.

However, limiting the argument to a short run view, the importance of putting Albanian farmers in conditions to produce higher levels of output, and in the most eco-

[3] Of course, the interaction of other aspects such as farmers skills, the functioning of domestic agricultural markets and the links with international markets of agricultural products should also be considered.

nomically efficient way must be stressed for some specific reasons. Even though in Albania there are no significant signs of food shortage and malnutrition, the recent Kosovan crisis has endangered the general Albanian economic instability and has led to a deterioration of the overall food security of many households and to an increase in poverty levels.[4] However, in some FAO reports it is also recognized that the precarious food security experienced by many Albanian households is attributable to the general economic and development difficulties that the country has experienced through the 1990s, rather than solely to the extraordinary circumstances created by the Kosovan crisis. Whichever is the case, achieving a higher level of food security – that is considered one of the key elements for sustainable agriculture – would mean sustainable agriculture and rural development would be more easily pursued.

To conclude, it must be added that to approach to the idea of sustainable agriculture in a more satisfactory way, the need of safeguarding ecological integrity should be taken into consideration as a further key aspect. With regard to this, it would be valuable to verify whether and how a land merging policy can affect the natural environment. The aim would be to understand eventual relationships existing between the land size of farms and some variables characterising the local natural environment. This could be the aim of further research.

References

Acharya G., 1998, Hydrogeological-Economic Linkages in Water Resource Management, PhD Thesis, University of York

Allen P. et Al., 1992, Sustainability in the Balance. Expanding the Definition of Sustainable Agriculture, University of California, Santa Cruz

Allen P. (editor), 1994, Food for the Future. Conditions and Contradictions of Sustainability, John Wiley & Sons Inc., New York

Altieri M. A., 1988, Beyond Agroecology: Making Sustainable Agriculture Part of a Political Agenda, in Allen P. et Al., 1992, Sustainability in the Balance. Expanding the Definition of Sustainable Agriculture, University of California, Santa Cruz

Berry A. R. and Cline W. R., 1979, Agrarian Structure and Productivity in Developing Countries, The Johns Hopkins University Press, Baltimore, Maryland

Conway G. R., 1997, The Doubly Green Revolution. Food for All in the 21st Century, Penguin Book s Ltd., London

Conway G. R. and Barbier E. B., 1990, After the Green Revolution: Sustainable Agriculture for Development, Earthscan Publication Ltd., London

Cornia G. A., 1985, Farm Size, Land Yields and the Agricultural Production Function: An Analysis for Fifteen Developing Countries, World Development, Vol. 13, No. 4, pp. 513-534

Douglass G. K., 1984, Agricultural Sustainability in a Changing World Order, Boulder Co., Westview Press

Food and Agricultural Organization (FAO), 1988, Aspects of FAO Policies, Programmes, Budget and Activities Aimed at Contributing to Sustainable Development, FAO Council Paper, CL. 94/6

Food and Agricultural Organization (FAO), 1999, Special Reports: World Food Programme Crop and Food Supply Assessment Mission to Albania, July, Rome

Francis C. A., 1988, Research and Extension Agenda for Sustainable Agriculture, in Allen P. et Al., 1992, Sustainability in the Balance. Expanding the Definition of Sustainable Agriculture, University of California, Santa Cruz

Giligan D. O., 1998, Farm Size, Productivity and Economic Efficiency of Farms by Size in Honduras, American Journal of Agricultural Economics, Vol. 80, No. 5

Gujarati D. N., 1995, Basic Econometrics, McGraw-Hill, Inc., 3rd Edition, New York

Hanley N. - Shogren J. F. - White B, 1997, Environmental Economics in Theory and Practice, MacMillan Press Ltd., London

Hatziprokopiou M. et Al., 1996, Production Structure, Technical Change, and Productivity Growth in Albanian Agriculture, Journal of Comparative Economics, No. 22, pp. 295-310

Henao J., 1994, Prodhimi bujqesor ne Shqiperi, verghim socialekonomik 1993 - 1994, Ministria e Bujqesise dhe Ushqimit, Rrepublika e Shqiperise, Tirane

INSTAT - Directorate of Statistics and Information, 1996, Shqiperia ne shifra (Albania in figures), May, Tirane

Lockeretz W., 1988, Open Questions in Sustainable Agriculture, in Allen P. et Al., 1992, Sustainability in the Balance. Expanding the Definition of Sustainable Agriculture, University of California, Santa Cruz

Lynam J. K. and Herdt R. W., 1989, Sense and Sustainability: Sustainability as an Objective in International Agriculture Research, Journal of Agricultural Economics, Vol. 3, pp. 381-398

Metcalf D., 1969, The Economics of Agriculture, Penguin Books Ltd., Harmondsworth, Middlesex, England

Ministry of Agriculture and Food of Albania (MAF), 1999, unpublished data

MoAF/IRP, 1997, Technical Report no. 6. Analysis of Audit 1996 and Budget 1997 from WUAs in Seven Districts, August, Tirane

Morone G. (editor), 1998, Sviluppo umano e sostenibile in Albania. Stato e Mercato. Problemi di riorganizzazione strutturale nella fase di transizione, Franco Angeli, Milano

Pugliese L., 1998, Analisi dei settori economici. Agricoltura allevamento e pesca, in Morone G. (a cura di), Sviluppo umano e sostenibile in Albania, Franco Angeli, Milano

Vecchione V., 1998, Profili geopolitici e risorse umane e naturali, in Morone G. (editor), Sviluppo umano e sostenibile in Albania, Franco Angeli, Milano

Warriner D., 1970, Employment and Income Aspects of Recent Agrarian Reforms in the Middle East, International Labour Review, Vol. 101

World Commission on Environment and Development (WCED), 1987, Our Common Future, Oxford Press University, Oxford

Young R. A. and Haveman R. H., 1985, Economics of Water Resources: a Survey, in Kneese A. V. and Sweeney J. L., Handbook of Natural Resource and Energy Economics, Vol. II, Elsevier Science Publishers B. V.

[4] According to recent FAO assessment missions, around 12,000 families in rural Albania and more than 8,000 families in Macedonia provided (and in many cases are still providing) food and shelter to refugees driven out of Kosovo. In Albania, rural families hosted more than one hundred thousand Kosovan refugees. On average an Albanian family supported eight, and in some cases even up to 40 refugees. The annual per capita income in Albania is $ 650, while around 30 percent of the rural population live in poverty. Considering that agricultural technology is poorly developed and productivity is low, the alert launched by FAO is understandable (FAO, 1999).