# The Performance of Tunisian Agriculture: An Economic Appraisal

# Abdessalem Aoun\*

Jel classification: Q100, O130

#### <u>Résumé</u>

Cette étude examine le niveau de performance de l'agriculture tunisienne en utilisant des séries temporelles agrégées pour la période 1985-2000. La fonction puissance est utilisée pour formuler l'équation à estimer. Les résultats obtenus reflètent une production agricole coûteuse et, par conséquent, un niveau d'efficience faible. Ceci s'explique par des faibles rendements de deux catégories d'inputs (conventionnels et non-conventionnels) agrégés. Ainsi, il est impératif d'accomplir la mise à niveau du secteur agricole en vue d'améliorer sa compétitivité internationale. Enfin, l'étude présente un bref panorama des défis futurs majeurs du développement agricole tunisien.

#### Abstract

Cette étude examine le niveau de performance de l'agriculture tunisienne en utilisant des séries temporelles agrégées pour la période 1985-2000. La fonction puissance est utilisée pour formuler l'équation à estimer. Les résultats obtenus reflètent une production agricole coûteuse et, par conséquent, un niveau d'efficience faible. Ceci s'explique par des faibles rendements de deux catégories d'inputs (conventionnels et non-conventionnels) agrégés. Ainsi, il est impératif d'accomplir la mise à niveau du secteur agricole en vue d'améliorer sa compétitivité internationale. Enfin, l'étude présente un bref panorama des défis futurs majeurs du développement agricole tunisien.

In Tunisia, the agricultural sector is a fundamental source of growth to the process of economic development. In terms of farming, fisheries, forestry, agribusiness operations and related services, this sector makes an important contribution accounting for about 13 percent of the gross domestic product, 22 percent of the employed labor force and 10 percent of the exports. Olive oil, fruits, and sea products being our major exported items (Tunisian Yearbook of Agricultural Statistics, 2003).

Since the 1980s, agricultural development efforts in Tunisia placed heavy emphasis on: (1) the promotion of public and private investments in agriculture, (2) the performance of the agricultural marketing system, (3) the use of technology and practices that both sustain and enhance productivity, and (4) the effectiveness of the agricultural extension service. Successful policies of agricultural development have been undertaken to promote the important role that agriculture must play in the economic system. Much attention has been paid to promote investment projects in agriculture. The Tunisian government developed a policy for niques, and the mechanization of farming. These advances have gone hand-in-hand with the promotion of investment projects in agriculture and credit facilities, and with more technically trained and educated farmers. However, improvements in the agricultural sector have not been uniform. In fact, many farmers are still poor because they lack capital, experience, and knowledge to become efficient producers. Also, despite the increase in agricultural production over time, Tunisia experienced a persistent deficit in its food trade balance. That is, net foreign trade for food is negative for most of the years of the 1985-2000 study-period (fig. 1).

credit and an intense sup-

port for entrepreneurs to

enhance their own capaci-

ty for designing, prepar-

ing and implementing a-

Thus, over the last two

decades, Tunisian agricul-

tural growth can be large-

ly attributed to the use of

nologies and the promo-

tion of investments in a-

gricultural projects. For

technological change, the

advances have mainly

consisted of the introduc-

tion of new seeds, new

breeds, water saving tech-

tech-

improved

gricultural projects.

output-enhancing

varieties,

Significant agricultural development took place in Tunisia and has contributed to an increasing agricultural production over time (fig. 2). Total agricultural output in value terms (millions of the 1990 constant Tunisian dinar) increased at an average rate of 3.4 percent per year from 1985 to 2000 (tab. 1). The cost at which Tunisia has achieved major increases in agricultural production and a significant contribution to the other sectors of the economy will be examined in this paper. In other words, as no empirical research on the long-term returns has been carried out, we are still ignorant of the real contribution of the major inputs required in the production process.

# 1. Introduction

One of the basic needs of human life is, of course, food. Thus, there is probably no greater challenge facing developing nations, today, than agricultural development. The continuing importance of agriculture in the economies of the developing world is mainly reflected in: (1) the increase of food security, (2)the promotion of agro-industries, (3) the increase in foreign exchange earnings, (4) the reduction of rural poverty, and (5) the development of agricultural marketing.

<sup>\*</sup> Ecole Supérieure d'Horticulture et d'Elevage

Chatt Mariem Sousse, Tunisia



Over the years, Tunisia has concluded trade and partnership agreements with the European Union (EU) and it is a



member of the World Trade Organization (WTO). The partnership treaty signed between Tunisia and the European Union in 1995, offers new opportunities to reinforce partnership in the agricultural sector and to promote agricultural trade between Tunisia and the European Union. Certainly, the prospect of increased competition continues to cause concern to Tunisian producers. Most farmers may be faced with serious questions concerning their ability to compete and to seize the opportunities of the global economy. The immediate challenge facing Tunisian farmers is how to be well prepared and to build the required capacity that will allow them to compete more effectively, and to fully participate and assume a dynamic role in the global trading system. These objectives call for an assessment of the performance of the Tunisian agriculture, on the way to progressively integrate the international agricultural trading system.

In this paper, first a basic econometric model will be outlined in order to provide estimates of the returns to the two main input categories, i.e., total agricultural investment and all the remaining variable inputs. Second, the major future challenges facing Tunisian farmers will be presented.

# 2. Theoretical Framework

In this analysis, a multiplicative power production function of the generalized Cobb-Douglas type is used to specify a theoretical model in which aggregate output is directly related to the strategic input categories in the production process. The choice of the power function from among several other al-

ternative forms is based on the following criteria: 1. The function is linear in the logarithms, which is convenient for many data transformations.

2. Returns to scale and the elasticity of production can be directly evaluated from the function's parameters. Therefore, one can use the estimates of the coefficients directly as elasticities of production.

3. This functional form is the most appropriate for fitting real-world data because it allows for diminishing marginal returns for all factors of production.

4. The survey of agriculture economics literature reveals that the power function has become the fundamental input-output relationship in econometric research (Debertin 1986; Heady and Dillon 1972).

Thus, the aggregative function to be estimated is:  $Y = a X_{1}^{\beta_{1}} X_{2}^{\beta_{2}}$ (1)

This equation may be expressed more conveniently in logarithmic form as

$$\operatorname{Ln} \mathbf{Y} = \mathbf{\beta}_0 + \ \mathbf{\beta}_1 \ln \mathbf{X}_1 + \ \mathbf{\beta}_2 \ln \mathbf{X}_2 \tag{2}$$

where Y = aggregate output,  $X_1 = the aggregate$  of conventional variable inputs,  $X_2 = total$  agricultural investment, and  $\beta_0 = ln a$ .

The properties of the power function (Cobb-Douglas type) are quite well known. The regression coefficients  $\beta_1$  and  $\beta_2$  measure the elasticities of output with respect to the input category. The sum  $\beta_1 + \beta_2$  gives information about returns to scale, that is, the response of output to changes in the inputs. If  $\beta_1 + \beta_2 = 1$ , then there are constant returns to scale. If  $\beta_1 + \beta_2$  is less than one, there are decreasing returns to scale. Finally, if the sum is greater than one, there are increasing returns to scale.

## 3. Data

Aggregate time-series data (1985-2000) for this study are obtained from the Tunisian yearbook of agricultural statistics which remains the only comprehensive source of data needed for this analysis.

Also, it is important to note, that throughout this study, we refer to agriculture in terms of farming, forestry, and fisheries. By fishery, we mean the industry of catching, processing, or selling fish, shellfish, or similar aquatic products. Thus, the variable Y (the output variable used in this study) is the total value of all agricultural sales, i.e., the aggregate output of farming, forestry, and fisheries, measured in value terms (millions of constant 1990, Tunisian dinar).

The variable  $X_1$  is total variable cost for the agricultural sector, measured in value terms (millions of constant 1990, Tunisian dinar). Finally, the variable  $X_2$  is total agricultural investment, measured in value terms and reflects increases in both quantities and prices (millions of Tunisian dinar). Of course, in the long run since farmers and entrepreneurs can make major adjustments, all costs and investments can be treated as variable.

## 4. Empirical Results

Statistical estimates are computed by ordinary least squares (Greene 1987-1990; Gujarati 1978) and can be represented as follows:

 $\begin{array}{ll} \ln Y = 0.7227 + 0.8215 \ln X_1 + 0.3153 \ln X_2 \\ \text{Std. Error} & (0.204) & (0.044) \\ \text{T-ratio} & (4.024) & (7.169) \\ \text{R}^2 = 0.859 & \text{F value} = 39.591 & \text{df} = 13 \end{array}$ 

From a purely statistical viewpoint, all coefficients display theoretically admissible signs. Based on the computed t ratios, each of the estimated coefficients is individually statistically significant at the conventional 5 percent level. The R<sup>2</sup> value of 0.859 (i.e., the overall goodness of fit of the model) shows that the estimated regression fits the data quite well. That is, the two explanatory variables or input categories X<sub>1</sub> and X<sub>2</sub> explain about 86 percent of the variation in the (log of ) aggregate agricultural output. Furthermore, the F value is obviously highly significant.

From an economic standpoint, as indicated in equation (3), in the Tunisian agricultural sector for the period 1985-2000 the output elasticities of the two strategic input categories or aggregate measures ( $X_1$  = variable inputs and  $X_2$  = total agricultural investments) are 0.8215 and 0.3153 respectively. Thus, if we use the elasticity of production as a proxy of the productivity of inputs, we can state that, over the period of study, holding  $X_2$  constant, a 1 percent increase in all variable inputs (in terms of money spent or total cost) led on the average to about 0.8 percent increase in total agricultural investment led on the average to about 0.3 percent increase in total agricultural investment led on the average to about 0.3 percent increase in total agricultural investment led on the average to about 0.3 percent increase in total agricultural output. Adding the two output elasticities, we obtain 1.1368, the returns-to-scale parameter. Therefore, over the period of the

Table 1. Rates of Change in Agricultural Output, Input, and Productivity, Tunisia, 1985-2000 (percent)

	• •		
	Total output	Total inputs	Total productivity
1985-86	-12.0	-11.6	-0.4
1986-87	19.3	6.8	12.6
1987-88	-21.3	-0.6	-20.7
1988-89	2.2	4.2	-2.0
1989-90	25.6	16.7	8.9
1990-91	13.3	8.8	4.5
1991-92	5.7	7.4	-1.7
1992-93	-6.4	-2.2	-4.2
1993-94	-8.9	0.1	-9.0
1994-95	-10.0	3.0	-13.0
1995-96	29.3	12.0	17.2
1996-97	3.6	2.7	0.9
1997-98	-1.1	8.2	-9.2
1998-99	11.9	6.5	5.4
1999-00	-0.8	2.3	-3.1
Average	3.4	4.3	-0.9

Source: Tunisian Yearbook of Agricultural Statistics, 1992, 1999, and 2000.

- Total output is an aggregative measure combining

a gricultur e, forestry, and fisheries on a value basis.

- Total inputs are measured in value terms and include

conventional and non-conventional inputs.

study, the results indicate that Tunisian agriculture was characterized by constant returns to scale (assuming the parameter obtained to be almost equal to 1).

## 5. Implications and Recommendations

Over the last two decades, the Tunisian agricultural sector has played key roles in the economic development strategy of Tunisia. However, within the agricultural strategy, while we are not far from the efficacy objective, we still need more attention for the efficiency dimension. The two issues are clearly interdependent. The more difficult task (the challenging task) is to reach the efficacy while being at the same time efficient.

In today's world, management is the key ingredient to control and monitor farm business activities. Agriculture in Tunisia, as well as in most developing nations, has become highly modernized, i.e., operating with large amounts of capital and using the advantages of mechanization and new agricultural technology. Thus, management takes on a new dimension and importance based upon economic incentives to guide farmers in the decision-making process during the life cycle of the farm business.

In the context of an on-farm research conducted within a regional level and aimed at the promotion of farm management and an understanding of farmer problems in Tunisia, two sources of information on farmer circumstances are used: (1) interviews with farmers, and (2) observations in farmers' fields. According to farmers' feedback: (1) management contributes to the increased efficiency and productivity process, and (2) returns on resource inputs depend to a great extent on the management or entrepreneurial skills. In fact, most entrepreneurs and project managers expressed the urgent need to master more effective strategies in order to manage risk and uncertainty, marketing opportunities, technological change, and enterprise or business analysis (A. Aoun and A. Hajlaoui, Res. Rept., 2002).

The challenges of agricultural development today in Tunisia are mainly related to: (1) the promotion of management skills that strongly influence the performance of agriculture, overall economic growth, and the well-being of farmers and entrepreneurs; and (2) international competitiveness and the capacity to take advantage of export markets.

In this context there is a strong need to:

- Support current capacity strengthening, as Tunisian farmers are placed at a competitive disadvantage by the growing number of regional trade agreements overseas.
- Identify and implement adjustments and more effective development strategies in farming and fishing as better opportunities become available. In fact, the productivity of total investment can be increased through the acceleration of progress in human capital, technology, and efficient marketing systems.
- Create and promote the research capacity necessary to achieve productive and sustainable agricultural systems. Indeed, in many developing nations existing research facilities are not employed at full capacity; and most research programs are not directed to current agricultural problems that farmers face.
- Accelerate the privatization process of government-owned farms, operating in general at a high cost to the Tunisian economy.
- Stimulate small farm activity using an extension package of credit, research, extension education, training and marketing programs. Special efforts should be devoted to programs that increase the opportunities for poor farmers.
- Accelerate the application of scientific knowledge to farming in order to increase efficiency and competitive advantage. It is interesting to note that vertical coordination, which includes the linkage of successive stages in the marketing and production within one producer, is clearly vital to a marketing-oriented view of business.
- Fully exploit fishing operations and related industries. Within present management and technology, the long-run potential fish harvest is estimated to be somewhere in the range of 100 to 150 thousand metric tonnes. For Tunisia, deep-sea fishing offers the greatest potential if investments can be provided for this difficult operation.
- Analyze, improve and promote agricultural marketing management, which in turn provides important information for enterprise budgeting and analysis. In fact, an analysis of costs is important for understanding and improving the profitability of an enterprise or business.
- Design, prepare and implement effective and efficient agricultural projects. Gittinger (1982, p. 3) states that "projects are the cutting edge of development." However, we would be mainly concerned with the growing recognition of the importance of the feasibility of the chain of operations, and the availability of technical, financial and marketing packages to ensure the overall viability of agricultural investment projects.
- Carefully assess existing government policies with respect to the agricultural development strategy (efficacy and efficiency objec-

tives) and the long-term strategic economic reform process.

#### 6. Conclusion

The estimation of production functions is not an end in itself. Indeed, the process simply provides the framework through which input-output relations may be evaluated in economic terms in an effort to obtain a better understanding of the real world relationships.

According to the findings of this study, it is important to recognize that Tunisian agriculture during the period (1985-2000) was characterized by a poor performance and a high cost to the Tunisian economy. In other words, over the period of the study, the modernization of Tunisian agriculture was characterized by a high cost of production since the returns to the two aggregate measures are low. The estimated coefficients are 0.3153 for total agricultural investment (as one input category) and 0.8215 for the other remaining variable inputs (as a single measure). These findings are in harmony with Table1, indicating a negative average rate of change of the total productivity (-0.9) for the 1985-2000 period.

In this century, the changing world economic and political environment will provide a large variety of challenges and opportunities for agricultural development in the developing nations. In the decades ahead, Tunisia will have to reduce production costs by increasing productivity in order to gain international competitiveness. Equally important, the productivity of investments will greatly affect the performance of farming and fishing activities.

Agriculture, which is fundamental to almost all economies, is becoming a business in Tunisia. Tunisian farmers have been progressive in the adoption of new skills and farming techniques. They are receptive to change and willing to accept new ideas susceptible to generate increases in productivity. However, the capacity of the Tunisian economy to implement the right adjustments in alternative production capabilities and to deal effectively with the farming and fishing problems has to be deepened and expanded.

Finally, it is fundamental to state that without a timely and correct response to the current challenges, farming and fishing activities in Tunisia cannot expect to survive in a changing and complex international-economic environment; and we cannot, therefore, be optimistic about the prospects of trade liberalization for either agricultural commodities or processed agricultural products.

#### References

Debertin, David L., 1986. Agricultural Production Economics, Macmillan Publishing Company, New York.

Gittinger, J. Price, 1982. Economic Analysis of Agricultural Projects, The Johns Hopkins University Press, Baltimore, Maryland, U.S.A.

Greene, W.H., 1987-1990. The Econometrics Toolkit, Econometric Software, Inc., Bellport, New York.

Gujarati, D., 1978. Basic Econometrics, McGraw-Hill Book Company, pp. 108-109.

Heady, Earl O., and John L. Dillon, 1972. Agricultural Production Functions, Ames, Iowa: Iowa State University Press.

Ministry of Agriculture, Water Resources and Environment. Yearbook of Agricultural Statistics, 1992, 1999 and 2001, Tunisia.