THE GREEK FARMER AND THE USE OF HIS RESOURCES

1. Introduction

In their efforts to bring the process of economic development under control, economists have long been preoccupied with identifying and explaining the components of economic growth. In recent years two of the components of development have received special attention: the quantity of inputs that enter the production process —the number of coffee beans that are put in the coffee grinder, so to speak; and the technology employed in the process of production— the design of the coffee grinder itself. International aid for economic development has emphasized both of these components of growth.

The Marshall Plan is an example of the approach to development through increasing the quantity of factors of production —especially capital. As long as the marginal product of an input is above zero, increasing its quantity increases total output. This approach is conceptually uncomplicated.

The various Technical Assistance Programs are examples of the approach to development through technological change. Technological change is broadly identified with the concept of dynamic or structural efficiency. It involves transformation of the production function—or pushing outward the production possibility curve. The same amount of measured inputs can now produce a larger output becauses of better "know-how." "Know-how" may well be a catch-all term for our ignorance. It may just represent "non-conventional inputs" that we have been unable to measure, such as education, native intelligence, environment, unaccounted qualitative improvements in existing inputs, etc. Technological change is statistically measured in terms of the macroeconomic "unexplained residual" — another reminder that it is a grab bag. It has been found to account for between 50 to 80 per cent of the rate of growth in advanced countries.[1] For Greece, Archibald has estimated its contribution at slightly over 50 per cent of the annual rate of economic growth in the period 1951-61 [2]. A most impressive pay-off!

1. For examples see [30] [31] [3] [22] [6].

Yet, the approach of increasing the quantities of factors of production and increasing technology has left many puzzles unanswered. Historical evidence suggests that the rate of growth in output has usually been much larger than the rate of increase in the resources used.[2] International aid in the form of the Marshall Plan and Technical Assistance Programs has been applied to the postwar reconstruction of Europe (and Greece is also a case in point) with phenomenal success! Similar aid programs have produced dismal failures in Asia and South America!

This paper is devoted to a third and as yet uncelebrated component of economic development: static allocative efficiency. It refers to the way in which the existing resources of production are utilized in the process of economic development. Do people in underdeveloped countries make the best use of resources available, given the existing level of techniques? If they do, what are the implications of this propositions for the future of economic development in a particular country? If they don't, what is the toll that the misallocation of resources might be taking upon the rate of economic growth?

Explicitly, this paper relates to agriculture. The empirical evidence adduced refers to a random sample of Epirus farms that the author had the chance to study in depth in 1963-64.

2. *The Importance of Allocative Efficiency in Economic Development*

The economic function of the firm is to bid resources away from alternative uses and to combine them in the production of a certain output basket: the manufacturer bids capital away from the construction industry to employ it in turning out steel; the farmer bids land away from the production of tobacco in order to produce wheat; the laborer shifts his labor from the consumption activity of leisure or from building a highway to the cultivation of his vegetable garden. As a result, this transfer of resources may lead to an increase in the aggregate output of society—or in the total social welfare, if we also consider consumption as an activity. Then the entrepreneur who masterminded this increase is rewarded by adding to his personal wealth, i.e., by reaping profits. On the other hand, a transfer of resources may decrease social output. We term this "waste," and the entrepreneur who engineered the waste is usually accountable to society for making up this loss through the sacrifice of his personal wealth [1].

Economists are able to predict the relative success that different firms

2. For documentation of this cf. [25, pp. 5-6].

will meet in their attempts to enhance social welfare—and therefore maximize their profits—by comparing the marginal cost and the marginal revenue of the resources they are using. As long as the last unit of a resource a firm employs yields as much as it would have yielded in alternative employments —its opportunity cost—the firm is efficient. If the last unit of a resource yields less than what it could have produced elsewhere, the firm is wasteful and it will be penalized by taking losses. If a resource yields at the margin more than its opportunity cost, the firm could expand its utilization of this resource and still add to its profits.

To state only the proposition of allocative efficiency —or the equimarginal principle— serves both to signify its importance for economic development and to awaken lying dogs!

Allocative inefficiency may be a necessary and sufficient condition to explain poverty. Underdeveloped countries may be poor because they are inefficient! This seems to be a fruitful angle for studying economic development.

On the other hand, testing for allocative efficiency is to suggest that Economic Theory is universally applicable in less developed countries. The two necessary conditions for achieving the classical Paretian optimum are economic motivation and operation of the market mechanism. Existence of an effective market mechanism implies efficiency in exchange. Economic motivation refers to efficiency in production and means economic rationality—rationality not in the reformer's sense of the word that evaluates the ends but in the economist's meaning of utility theory that is concerned with the consistency of the means for achieving given ends.

Although these two propositions form the foundation of standard Economic Theory it is frequently asserted that Economic Theory lacks realism with respect to less developed countries and thus becomes inapplicable.[3] Markets are supposed to be imperfect to such a degree that if allowed to operate they cause social waste. The rationality of people in less developed countries is viewed by a good number of (otherwise good) economists with an attitude ranging from the "willful suspension of disbelief" to the outright rejection. It is rather common to brush aside the traditional attitudes of farmers' response to price incentives. It is asserted that the signals of the market mechanism are not transmitted to the farms, or, if transmitted, they are disregarded. Peasants lack economic motivation. They are indolent and they work too

3. The realism-relevance distinction on the applicability of Economic Theory appears in [19].

little; or they are irrational and they work too much (i. e., they work to the point that they bring their marginal product of labor to zero). They save and invest too little in terms of what capital earns. They do not cultivate their lands to the fullest. They are far from the stereotype of the economic man. They are backward, they are slaves to tradition, they reject change!

It is important to find out whether this is indeed the case. If it is, Economic Theory lacks realism in the framework of economic development. Inefficient traditional agriculture is apt to be *a way of life*. Ways of life are self-rewarding aims. Their satisfactions come more from the means than from the ends which a given set of means achieves. Ways of life are slow to change —and change with them is more of an Ibsenian "either all or nothing'' proposition. *They are important but they are not sensitive variables.* They are not open to marginal adjustments. If so, they are outside the professional province of the economist and exclusively within that of the sociologist or the social anthropologist.

If traditional agriculture is efficient it is most likely to be *a way of making a living*. Ways of making a living are means towards ends. Their satisfactions come mainly from the degree to which the means are capable of accomplishing the aim. Means are more susceptible to change. If a new set of means comes along that makes it feasible to accomplish the aim in a better (i.e., cheaper) way, it will be adopted. Ways of making a living are open to marginal changes. *They are important and sensitive variables.* If so, they are a valuable tool in the hands of the development economist.

Suppose one concedes the existence of economic motivation and the operation of the market mechanism in less developed countries. Assume that Economic Theory is realistic. Still, how relevant is it as an approach to the problems of the underdeveloped world? Static, one-at-a-time marginal adjustments that rely on given resources, techniques and patterns of consumer demand may not be sufficient to correct for the fundamental disequilibria in factor proportions which are prevalent in underdeveloped areas. No improvement in allocative efficiency can rectify the cumulative disequalizing forces that may have led to economic dualism in many an underdeveloped country. Isn't it time to concentrate exclusively on dynamic changes and to join with Myrdal in his exhortation of challenge to the young economists of the less developed countries ? [20 p. 101].

> In this epoch of the Great Awakening, it would be pathetic if young economists in the under-developed countries got led astray by the predilections of the economic thinking in the advanced countries. . . I would instead wish them to have the courage to throw

away large structures of meaningless, irrelevant and sometimes blatantly inadequate doctrines and theoretical approaches, and to start their thinking afresh from a study of their own needs and problems.

It is difficult to estimate accurately the magnitude of the component of economic development that can be directly attributed to allocative efficiency.[4] Given the present shortage of testable and tested hypotheses about the process of economic development, any answer would be based on educated guesses. At first glance, it seems that allocative efficiency can be responsible for only relatively small improvement compared to the large potential dynamic gains to be obtained from technological change. Nevertheless, in the context of economic development even small gains may prove quite significant. To quote Hla Myint: [19 p. 485].

> ... the underdeveloped countries are too poor to put up with the burden of preventable waste that arises even within the static framework of given wants, techniques and resources. As Galbraith has suggested in his *Affluent Society*, only the richer advanced countries can afford to take an indulgent view toward the misallocation of resources.

Furthermore, it may be that the existence of allocative efficiency is a necessary condition for the pursuit of dynamic changes in agriculture and for the achievement of structural efficiency. A counter-factual alternative may serve to demonstrate the proposition. Assume that farmers do not respond to economic incentives. Aren't they then unlikely to embark on a program of dynamic transformation of agriculture, the pay-off of which lies almost entirely in the economic sphere? Assume that the market mechanism does not operate. Wouldn't this seriously inhibit farm modernization, to the extent at least that modernization is adjunct to production for exchange and to monetization of the agricultural economy? If allocative efficiency is indeed so im-

4. An impressive array of studies quantify the component of growth that is attributable to allocative efficiency at a fraction of 1 per cent [11] [13 p. 132] [15] [29] [27] [33] with a maximum of 15 per cent [12]. It should be entirely clear that this paper does not refer to the same kind of allocative efficiency. All the previous studies deal with misallocation of resources that is due to restrictions of entry into the field, e.g., monopoly, tariff barriers, etc. They subsume that within these restrictions, the entrepreneur still maximizes profit by equating marginal benefits to opportunity costs. This paper refers to the kind of inefficiency that arises when entrepreneurs are not maximizers. It is an entirely different kind of efficiency and one might want to keep that in mind by referring to it as "lower level" or "basic allocative efficiency."

portant for the achievement of structural efficiency, the impressive quantification of the role of the latter in the process of economic development certainly includes an attribution error: it has been credited with some of the benefits of allocative efficiency! Likewise, if allocative efficiency is indeed significant, this might make the difference between the success or failure of otherwise identical international assistance programs.

3. *The Tests for Allocative Efficiency*

One series of tests of allocative efficiency that has been performed for underdeveloped countries relies on observations over time —be it hard statistics of time series data or anecdotal accounts of casual and/or punctilious observers of other cultures.[5] These tests focus on studying the relationship between changes in the behavior of people in traditional economies as a lagged function of changes in some independent variables— e.g., the response of quantity supplied to an increase in price, the amount of "wasteful" conspicuous consumption that is associated with increased incomes, etc. Although important and highly informative, by their very nature these are weak tests of allocative efficiency. The hypothesis is rejected only if complete insensitivity to economic incentives is established—and this would have been a rather surprising finding! Otherwise, partial corroborative evidence may be used either to support or to attack the rationality hypothesis, depending on the researcher's predilections. At the close of this paper I will provide some examples of this type of efficiency tests that have been presented by astute observers of the people of rural Greece.

More rigorous tests of allocative efficiency may be based on cross section microanalytic data. Then the question becomes one of judging whether individual firms attempt to achieve allocative efficiency and also of measuring the degree of success they meet in this attempt. The unreliable quality of microanalytic data may be the main reason for the relative scarcity of such tests in the literature. The focus in this paper is on testing the efficiency of peasant Greek agriculture on the basis of microanalytic cross section data.

4. *Productivity Analysis of Epirus Farming*

In this section two alternative hypotheses are submitted to a test:

Hypothesis I is that traditional agriculture, as exemplified by the case of Epirus, is inefficient in using the resources at hand.

5. For an excellent account of such tests see [26] [16].

If this hypothesis is confirmed, important policy implications arise: We have a sufficient explanation of poverty—poor countries are poor *because* they are inefficient; other things being equal the conventional international assistance programs are expected to yield low returns; the existence of economic irrationality provides sufficient grounds for the rejection of Economic Theory in underdeveloped countries on account of lack of realism. On the other hand, if Hypothesis I is rejected, this leads to the alternative:

Hypothesis II, which is that traditional agriculture, again in the example of Epirus, is efficient in using the resources at hand.

Confirmation of this hypothesis leads to the implication that we are still looking for an explanation of poverty. Poor countries are poor *despite* the fact that they are efficient. If so, their poverty might be due to other factors, e.g., to the low stock of resources. In this event, conventional foreign assistance that concentrates on the increase in the quantities of traditional (e.g., capital) and non-traditional (e.g., education) inputs of production is expected to yield sizable returns. Also, if this hypothesis is confirmed, Economic Theory becomes realistic, relevant and applicable in the development context.

Epirus, the domain for this study, is the least developed region of Greece —with the possible exception of Crete and Thessaly. Its backwardness is evidenced not only by the low per capita gross domestic product ($ 287 in 1962 as compared to $ 627 for Attica), but also by a number of relevant socio-economic indicators that propose to depict "standard of living" comparisons.[6] Furthermore, due to its seclusive geography, its mountainous terrain and the lateness of its incorporation into the free Greek state, the region displays most of the characteristics of the typical conclave economy.

The data were collected by lengthy and in depth interviews with a random sample of households. The questionnaire interviews, which were designed by the author, were carried out with the assistance of 34 interviewers and for 25 days, for both the pilot survey and the sample survey. In the sample survey 650 questionnaires were collected from households in 110 villages and 3 cities of the region. This study utilizes only the 430 farm household questionnaires.

The Production Function

The basic approach of this study consists of estimating an unrestricted

6. For more details on these comparisons and also on the background of the study see [37].

production function of the Cobb-Douglas type, using separate variables for each input category. The explicit form of the postulated population production function in output Y and inputs $X_1, \ldots, X_i \ldots, X_n$, is:

$$(1) \qquad Y = AX_1^{\beta_1} \ldots X_i^{\beta_i} \ldots X_n^{\beta_n}$$

By using a logarithmic transformation the function is written:

$$(2) \qquad y = \alpha + \beta_1 x_1 + \ldots + \beta_i x_i + \ldots + \beta_n x_n + \varepsilon^*,$$

where $y = \log Y$; $x_i = \log X_i$; $\alpha = E(\log \varepsilon)$; and $\varepsilon^* = \log \varepsilon - E(\log \varepsilon)$, as will be defined immediately below. In the regression equation (2) —and similarly for (1)— y is the regressand; x_i are the regressors; β_i are the population regression coefficients; and ε^* is the disturbance term which is due to the fact that the postulated regressors do not entirely explain the regressand since some input factors may have been omitted from the function.[7]

In specifying equation (2) empirically I derive from the data its estimate of the form:

$$(3) \qquad \hat{y} = a + b_1 x_1 + \ldots + b_i x_i + \ldots + b_n x_n + u,$$

where b_i are the sample regression coefficients.

The main results of fitting equation (3) to data from the sample of Epirus farms are summarized in Table 1.

Four regressions are reported in Table 1. Regressions R21 and R22 are fitted for the whole sample of farms, the former with five independent variables and the latter with six. Regressions R21.1 and R21.2 distinguish between small and large farms, respectively. This distinction corresponds to farms with cultivated land of less and more than 20 stremmata, respectively —the mean value of the land variable for the whole sample. The reasons for the grouping in two sizes of farms are both economic and statistical. The economic logic of production suggests that the sample observations of the underlying population may not obey the same law over the entire range of the independent vari-

7. On the statistical specification of the estimating equation see [37 ch. 10]. For the complete specification of the residual term see [8] [9].

TABLE 1

PRODUCTION COEFFICIENTS AND RELATED PRODUCTION FUNCTION STATISTICS FOR FITTED REGRESSIONS

Description and Regression Number	Variables							Sum of Coeffi-cients	R^2	Number of Farms
	Y (output)	X_1 (labor)	X_2 (land)	X_3 (plant)	X_4 (equip-ment)	X_5 (live capital)	X_6 (educa-tion)			
Coefficients										
R21	—	.442 (.058)	.092 (.042)	.048 (.012)	.041 (.015)	.259 (.034)	—	.882	.626 (.177)	430 All Farms
R21.1	—	.428 (.067)	.064* (.056)	.057 (.015)	.059 (.018)	.232 (.043)	—	.840	.504 (.179)	289 Small Farms
R21.2	—	.541 (.120)	-.117* (.120)	.027* (.021)	.005* (.025)	.272 (.057)	—	.728	.409 (.170)	141 Large Farms
R22	—	.441 (.057)	.093 (.042)	.046 (.012)	.044 (.015)	.247 (.035)	.138 (.067)	1.009	.794 (.177)	430 All Farms
Sample means (geometric)										
R21	9,817 (2.53)	176 (2.19)	12 (2.67)	366 (10.43)	335 (8.06)	4,558 (3.14)	—			
R21.1	6,884 (2.68)	128 (1.98)	7 (2.07)	258 (10.03)	214 (7.49)	3,027 (2.77)	—			
R21.2	20,320 (1.97)	338 (1.68)	35 (1.60)	744 (9.66)	838 (6.94)	10,543 (2.46)	—			
R22	9,817 (2.53)	176 (2.19)	12 (2.67)	366 (10.43)	335 (8.06)	4,558 (3.14)	2.24 (0.02)			
Marginal products										
R21	—	24.64	75.51	1.29	1.21	.56	—			
R21.1	—	23.01	*	1.52	1.90	.54	—			
R21.2	—	32.59	*	*	*	.52	—			
R22	—	24.41	75.94	1.23	1.29	.53	606.40			

TABLE 1 (ont.)

PRODUCTION COEFFICIENTS AND RELATED PRODUCTION FUNCTION STATISTICS FOR FITTED REGRESSIONS

Notes :

Non-starred coefficients *are* significantly different from zero at a probability level of $\leqslant 5$ percent.

* Starred coefficients *are not* statistically significant at a probability level of $\leqslant 5$ percent. The marginal productivities were not computed for the statistically non-significant coefficients.

( ) Numbers in parentheses are the calculated standard errors of the respective coefficients or the standard deviations of the respective means.

Regressand :

Y : log of (gross value of agricultural production in drachmas).

Regressors :

X_1 : log of (man-days worked).
X_2 : log of (number of stremmata cultivated). One stremma is equal to 0.247 acres.
X_3 : log of (estimated value of current services of plant plus operating expenses for plant in drachmas).
X_4 : log of (estimated value of current services of equipment plus operating expenses for equipment in drachmas).
X_5 : log of (estimated value of current services of live capital plus operating expenses for live capital in drachmas).
X_6 : log of (total years of education of farm household members age 15-69, divided by the number of farm household members age 15-69).

Marginal products :

They are estimated from differentiating equation (1) with respect to each input and by using the mean values of input output :

$\frac{\theta Y}{\theta X_i} = \beta_i \frac{\bar{Y}}{\bar{X}}$. They are expressed in the following dimensions :

labor : drs. per workday
land : drs. per stremma
plant : drs. per dr.
equipment : drs. per dr.
live capital : drs. per dr.
education : drs. per year change in average household education.

Source : Survey data.

ables. This may be likely in view of the result of the grouping upon the coefficients, especially upon labor. Statistically, by grouping the farms we "hold constant" the unobserved variables that may be correlated with farm size (e.g., entrepreneurship?).

The Results

That the sum of production coefficients is not significantly different from one, suggests constant returns to scale, i.e., by doubling all factors of production we double output. The same result is suggested by similar international studies of agriculture, and this is what one would have expected *a priori* if we assume a closed set of factors of production and full divisibility of all factors. The former assumption is violated by the omission of management. If management varies less than proportionately with changes in the other factors over the range of the sample observations, omission of management leads to underestimation of returns to scale. By including the education variable, however, the sum of the coefficients becomes equal to one. With the same *a priori* reasoning as above, one might conclude that education is a good proxy for entrepreneurship.

The input coefficients are interpreted as the respective input elasticities of output.[8] They show the percentage increase in output that is expected to follow a one per cent increase in any input. For example, a one per cent increase in the quantity of labor employed would lead, on the basis of R21, to a .442 of one per cent increase in output. (One can roughly say that doubling the quantity of labor would increase output by 44 per cent.) Second to labor in importance is the coefficient of live capital of .259 (in R21) and third that of education with .138 (in R22).

The input coefficients may also be interpreted as the proportion of output that would go to each factor of production under perfect markets and constant returns to scale.[9] One who is acquainted with the labor intensive technology of Greek agriculture would not be surprised to find out that the share of labor

8. By differentiating (1) with respect to X_i we obtain:
$\frac{\theta Y}{\theta X_i} = \beta^i \frac{Y}{X_i}$ Dividing through by $\frac{Y}{X_i}$ we have: $\frac{\theta Y}{\theta X_i} \cdot \frac{X_i}{Y} = \beta i.$

9. According to Euler's theorem, the share of factor X_i is equal to its marginal product times the quantity of factor X_i. Therefore, from footnote 8 we can write: $\frac{\theta Y}{\theta X_i} X_i = \beta_i Y$. In perfect markets and under constant returns to scale the sum of the shares of all factors exhausts the product.

is just under one-half of the total output. The share of education, at 14 per cent, follows that of live capital in importance. Although one might venture the guess that the relative share of education is rather small (by doubling the current educational inputs, output would increase by 14 per cent), it turns out that the absolute effect of education is very significant. This will become clear from the discussion of marginal productivities and of the mean values of the variables.

As stated above, the marginal product of a factor can be computed as the product of the factor's elasticity times its average output. We specified that the population regression relationship operates for all sample farms. Therefore, given the relevant production elasticities, marginal productivities can be computed at any combination of input and output levels, provided that these levels do not lie outside the range of the sample observations. It is convenient, however, to present the discussion in terms of the "average farm", i.e., the farm for which managerial ability, the level of product demand, and factor supplies are at their mean values for the group of farms as a whole. The mean values that enter the computations are the geometric (rather than the arithmetic) mean values. It seems that estimation at the geometric averages —i.e., at the point of logarithmic means— is the most relevant in the context of a Cobb-Douglas application.

The geometric means of the variables and the marginal productivities of the inputs are also presented in Table 1. The dimensions of these values are given in the notes accompanying the table. Brief discussion of the units of the labor, capital, and education inputs may be useful.

Labor is expressed in homogeneous man workdays actually employed on the farm. For this purpose, work performed by women and children was converted into equivalent man workdays [37 ch. 6] [23]. Capital is expressed in terms of the annual flow of services from plant, equipment and live capital inputs that are employed on the farm. This is a novel approach to the capital input concept, and it roughly corresponds to the annuity formulation of the relevant capital stock concepts. Under certain conditions, it represents the annual rent that a farm would have been paying if it had been renting the services of capital assets instead of owning the assets outright [37 ch. 7, 8, 9] [35] [36] [5]. Finally, education is expressed in terms of an index. It represents the sum of the years of education of all farm household members in the age brackets 15 to 69, divided by the number of farm household members in the same age bracket. The reason for concentrating on the education of the members in the 15 to 69 age bracket is that members in this age group are more likely to participate directly in farm activities, or, even if they don't, they can make their education easily transferable to the household members who do agricultural work. The interpretation, then, of the mean value of educational inputs is rather straightforward: the "average farm" had 2.24 years of education per farm member of age 15-69, whether this member was actually working on the farm or not.

Labor

We are ready to turn to the presentation of the marginal productivities of the inputs of production and to the comparison of the marginal products with the relevant opportunity costs of each factor (i.e., the discussion of "efficiency indexes"). The marginal product of labor, computed at the geometric mean of input and output, is 24.64 drs. (s = 3.22 drs) per man workday (R21). It is slightly lower for small and considerably higher for large farms, as one might have expected, since large farms use, on the average, larger quantities of complementary inputs of production. How does the marginal product of labor compare to the factor opportunity cost?

The weighted average wage rate per homogeneous man workday reported in the questionnaire for hired-in labor is 52.25 drs. (s = 14.46 drs.). The null hypothesis that the frequency distribution of the marginal productivities and the frequency distribution of the wage rates have the same means was rejected at the probability level $\leqslant 5$ per cent. Therefore, we conclude that the marginal productivity, as estimated from the overall regression, is significantly lower than the wage rate observed over the sample of farms. Still, this discrepancy, although important, is hardly surprising. The demand for wage labor in agriculture is only seasonal, concentrated mainly in the fall and spring seasons of peak agricultural activities. Agricultural labor "shortage" is prevalent during these seasons [23 especially Table 5] [34]. On the other hand, due to the low degree of industrialization in Epirus in the off-peak seasons of winter and summer there is no alternative non-agricultural employment offered and seasonal "surplus" labor is observed. During these seasons the opportunity cost of family labor is zero. By weighting the seasonal wage rate of 52.25 drs. by 56 per cent, which is the proportion of the total agricultural work in Greece that is performed in the two peak seasons [23, year 1960], we arrive at an approximation of the true year-around opportunity cost of labor of 29 drs. If this is true, the marginal productivity of labor, as computed from R21 (also from R21.1 and R22 and *a fortiori* from R21.2) is not significantly lower than the true opportunity cost of labor. Actually, the ratio of marginal product of labor to opportunity cost is .87 —very close to the efficiency index of 1.00 that would signify perfect resource allocation!

Land

The marginal product of land, computed at the geometric mean of input and output, is 75.51 drs. per cultivated standard (i.e., unirrigated) stremma per year for R21 (and approximately the same for R22). Data on the annual rent per stremma of unirrigated land in Epirus are not easily available. General agronomists' information, however, indicates that a reasonable estimate of the market opportunity cost of cultivated land in that region lies between 80 and 100 drs. per stremma— which is reputedly the modal value of the annual rental of land. If this is correct, the difference between the marginal product of land and its opportunity cost appears negligible. Actually, the efficiency index of marginal product to opportunity cost (the latter estimated at 90 drs.) is .90— again very close to 1.00!

Capital

Interpretation of the marginal product of capital is more difficult and computation of an efficiency index becomes strictly impossible. The marginal productivity of capital inputs is a pure number, since it is expressed in terms or output drachmas per input drachma. Our estimated marginal product of capital is closer to Scitovsky's *profit margin* [28], which expresses the return to a machine per year over the lifetime of the machine rather than to the *internal rate of return*, which shows how much a machine will be yielding per year to perpetuity. As a result we cannot directly compare this profit margin to a rate of interest in order to compute an efficiency index. However, for inputs that are measured in units of drachmas per drachma per year, marginal productivity coefficients of the order of 1.2 are usually considered reasonable in the literature [10 p. 968].[10]

10. The marginal productivity of live capital, although "low" is not surprising for two reasons. The first is connected with the age distribution of live capital assets in the sample of farms [37 ch. 9]. The second is that live capital is a unique measure of a vector of components that are rather heterogeneous and may be expected to have greatly varying productivity. This heterogeneity may have biased downwards the relevant production coefficients and this may account for the low marginal productivity estimates [37 ch. 10].

Education

The marginal product of education, computed at the mean of 2.24 years of education per farm household member of age 15 to 69, is 606 drs. It becomes evident from the mean value that this is primarily grade school education. The number of farm household members who had high school education was insignificant and any formal technical education was totally non-existent. Had it been possible to estimate the cost of providing one additional year of school education to 3.00 (s = 1.36) persons —the average number of farm household members aged 15 to 69 in the sample— we could have obtained some very meaningful comparisons of the costs and benefits of education in Epirus. This would have led to computing a social rate of return to education, and then we could have directly approached the question of overinvestment or underinvestment in the education of the farm population. Since we lack data for such comparisons, we can proceed from here only by compounding assumptions on guesswork.

Agricultural activities, as a result of one year's education imbedded in each member of a household, provide a real net (i.e., after deduction of the household's expenses for education) earnings stream of $Y_0, Y_1, \ldots, Y_n$ per year for the n years of the period. The alternative stream of earnings that the household would have received without education in the same period is $X_0, X_1, \ldots, X_n$. The marginal product of education is actually defined as the difference between these two alternative income streams:

$$(4) \qquad k_j = Y_j - X_j.$$

The capitalized value of one year's education per member of a household can then be expressed as:

$$(5) \qquad V(K) = \sum_{1}^{n} \frac{k_j}{(1+r)j}$$

where r is the relevant rate of discount, k_j is the marginal product of one year's education per household member in year j and n is the total number of years for which this education will retain its productive value.

Assume that the productive value of the resources imbedded by education on the "average" household member will last as long as this member remains in the labor force, e.g., to age 69. Furthermore, assume that one year of education bestowed does not depreciate with age (a reasonable assumption) nor does it appreciate with age (a rather extreme assumption, in view of the literature on learning curves and on learning by doing). Also, assume a static framework within which the marginal product of one year's "average" education will remain constant at 606 drs. for the rest of the productive life of the "average" household member. Under these assumptions equation (5) can be simplified to:

$$(6) \qquad V(K) = \frac{k}{r}\left[1-(1+r)^{-n}\right]$$

where k is the constant annual marginal product of one year's education per household member, r is the relevant rate of discount, n is the number of productive years remaining in each member's life until he reaches age 69 and $(1+r)^{-n}$ is a correction for the finiteness of life that tends toward zero as the length of the working life increases [4 p. 32].

The value of equation (6) was computed from annuity tables at 5 per cent and for n = 1 to 54 so that it covers all age brackets from 15 to 69. The results are weighted by the number of household members in each age bracket. Thus, the weighted capital value of one year of education per household member was estimated at 8,437 drs.[11] Since the average household has 2.24 years of education per member, the total capital investment in education is equal to 18,900 drs. per household.[12] This is a surprising finding! The capitalized value of education for the average household is higher than the capital value of all its other three forms of capital, which has been estimated at 17,393 drs., 3,341 drs., and 233 drs., for live capital, plant, and equipment assets, respectively! No matter how we approach education, whether from the point of view of capital investment, from the side of its marginal product, or from the aspect of its share in the total output, it seems that the meager amount of 2.24 years of education per household member is an important factor of production in our sample of Epirus farms! This may well be another shred of

11. Since this value was computed from the marginal product of education, we may consider it as the demand price for one year of education per household member.

12. I assume here that the marginal value of one year of education per household member is equal to the average value of one year of education. If the marginal product of an additional year of education is actually declining, the total capital investment in education is underestimated. The opposite, and more likely, is the case if the marginal product of one year of education is actually increasing, at least in the early stages of the educational process. Then the assumption used overestimates the total capital investment in education.

evidence pointing to the fact that the greatest asset of Greek agriculture is the farmers themselves and their quality!

Summary

In summary, this section has fitted production functions for a random sample of Epirus farms. From the fitted functions we estimated the marginal product for each input of production for the "average" farm. Resource utilization can be evaluated by computing an "efficiency index" —the ratio of the marginal product of a factor to its opportunity cost. For labor and land, the two inputs of production for which the efficiency index could be readily estimated, its value was close to one. An "efficiency index" could not be constructed for capital inputs and education. However, the marginal product of these resources suggests that there is no reason to suspect that their utilization is wasteful.

The efficiency index is produced jointly with many *caveats*. Even if there is equality of marginal product and opportunity cost in one sector of the economy, the conditions for an overall welfare optimum still may not be satisfied. If the marginal conditions are satisfied for only some inputs or in one sector of the economy, Pareto optimality still may not be obtained. Nevertheless the attempt to construct "efficiency indexes" is not in vain. There are some instances where it is desirable to fulfill a marginal condition, even if some conditions are not met elsewhere within a sector or in the economy [14].

One last question remains. We found that the sample of Epirus farms studied is efficient "on the average." What does this imply as far as the efficiency of individual farms goes? If all farms had also been individually efficient, we would have expected to observe that they have the same size, identical input-output ratios, the same input combinations. Indeed, they would all have been on the same point in the seven-dimensional space of inputs and outputs and there would have been no regression at all!

The usual interpretation of the production function is that, although individual firms attempt to maximize profits, they are not uniformly successful in doing so due to differences in their managerial abilities. This is one explanation of the residuals around the regression line [17], also [21, ch. 3]. Our test is mainly a test of whether individual firms *attempt* to be efficient, i.e., to maximize profits. Having found that "on the average" they *succeed* in being efficient, we may assign a high probability value to the event that individually they *attempt* to be efficient. If we had a target and a number of shooters, the closer the distribution of the shots to the bull's eye (stochos) the higher the probability that the individual shooters were aiming *at* the target. This is the usual interpretation of a stochastic relationship! [32 p. 4]

5. *Examples of the Agonistic Quality in Greek Farming*

There is a general tendency among urban intellectuals to deprecate the basic intelligence and rationality of the illiterate or poorly educated peasant or small farmer.

This paper lends support to the hypothesis that the Epirote farmer responds to economic incentives in a rational way and with a high degree of efficiency and sophistication. Peasants are intensely aware of the agonistic[13] quality in their life —agonistic in the sense of the Greek word agon, i.e., struggle or match. Dr. Ernestine Friedl reminds us that as one walks through the fields, the answer to his question "How is farming?" is most likely to be "palevoume" — "we are wrestling" [7 p. 75]. This answer is less of a cliché and more of an expression of keen awareness that farmers are constantly trying to match their aptitudes with the few available factors of production in order to extract the maximum output from niggardly Nature. A few examples may help to illustrate this aspect of farm life.

Observers are impressed by the coexistence of the old and the new in Greece —of the horse-drawn plow next to the brand new Italian tractor. The decision of the choice of techniques is not taken randomly nor is it necessarily based on conservatism or respect for tradition. The same peasant may decide to hire or not to hire a tractor for the fall plowing by considering the opportunity cost of his labor: if late summer rains have delayed the cotton picking which competes for hands at the time when the wheat fields should be plowed, farmers are most likely to substitute capital for labor and hire a tractor. Otherwise, if the opportunity cost of labor for the season is below its marginal product, farmers are likely to proceed with horse-drawn plowing [7 p. 21]. The coexistence of the ancient and the modern techniques, far from being evidence of cultural laggardness, manifests that farmers possess the economic sophistication to realize that the opportunity cost of the same factor of production varies between and within seasons.

Many observers have documented the willingess of the farmer to experiment[14] [18 pp. 92, 101] [24 p. 309] [7 p. 23]. Yet, when they stubbornly refuse to adopt a new technique or to experiment, it might be because they know

13. The adjective is borrowed from Dr. John Peristiani.

14. Ernestine Friedl [7 p. 23] quotes the farmer of Vasilika in 1956: "I've planted half of my forty stremmata of cotton by hand and the other half by machine to see which will

better. Kardamili farmers rejected the use of fertilizers for their olive trees—which might have enraged some agricultural extension agents. Yet to quote Dr. William Hardy McNeill [18 pp. 141-42]:

> A more sophisticated farmer told me that while the size of the fruit is increased by fertilizer, the quantity of oil is not increased in anything like the same proportion and its quality is lowered. Since the olive trees of this part of Greece are famous for the high quality of oil they produce, which commands a premium price in Athens and elsewhere, the use of fertilizer becomes a somewhat dubious economic advantage.

The same reluctance to experiment might be due to the fact that illiterate farmers are very versatile in calculating expected utilities! Contrary to what was usual in other villages, throughout the whole cluster of villages in Lacca Souli, the poorest villages in Epirus, the agricultural extension agent was hard put to produce for me one single "progressive" farmer. The common attitude on behalf of public officials is that this conservatism is the *cause* of the poverty of this area. I submit that it is only the *result* of poverty. In rational decision-making one weighs the marginal utility of the favorable outcome by its probability and compares it with the alternatives. For a farmer who lives in abject poverty the alternative, in case of failure of the experiment, might be the starvation of his family. Since he lacks some economic margin for experimentation, the very high marginal utility of his existing barely subsistence income, multiplied by even a low probability of failure, is still higher than the product of the marginal utility of the additional income times the high probability of success. The immediate implication of the Friedman-Savage hypothesis on risk-taking for economic development is that neither the very poor nor the very rich farmer can be counted upon to move the wheel of change. A corollary of this hypothesis might be that, at some very low levels of income, social welfare and social security assistance are necessary preconditions for productivity increases.[15]

One never ceases marveling at the economic sophistication of supposedly backward people! An excellent example is provided by Dr. Irwin T. Sanders

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turn out better. It's an experiment, you see." She adds that the machine planter must have been better, because in 1961 she found the same farmer having planted all his cotton by machine.

15. A vivid illustration of the confusion of priorities between social welfare assistance and production loans that characterized governmental policy, is provided by the old shepherd of Konitsa. He was telling me that he purchased a Jersey cow from the Agricultural Bank at a subsidized price and he obtained a forgivable loan for building a new concrete

from a conversation he had with Alekos, a villager around Larissa who had bought a tractor [24 p. 83].

> "At first I had to hire a driver for the tractor, but my boy rode around with him, asked a few questions, and learned how to drive. So the second season I turned the tractor over to my son." ... Alekos estimated that only 30 per cent of the tractor owners hired drivers and that the rest of the owners drove themselves or had members of their family who could drive. He thought that this shift away from hiring drivers would mean a trend from bigger tractors to smaller tractors for, as he put it, "If you are going to pay for a driver you might as well get a larger tractor and get your money's worth out of the driver. If you are going to do the work yourself, a small tractor is sufficient."

His prediction was entirely correct and his economic analysis impeccable! The price of small tractors, *in terms of large*, decreases as the cost of driver, which is the same for both tractors, decreases.[16] And according to the law of the downward sloping demand curve, the lower the relative price of small tractors, the more small tractors one would buy! This is exactly the same reason why one is likely to find more off-grade California oranges in California rather than in Alaska, and more fake Italian leather goods in Milano than in Honolulu! It is the result of the transportation cost which does not vary according to quality!

6. *Conclusion*

This paper is devoted to the examination of two hypotheses in connection

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stable for it–but, the cow died and he was in debt to the Bank as a result of the whole operation. To my question on the circumstances of the death of the cow the answer was squarely logical: "The hut was too damp and leaky for it. You see, I wouldn't have the family living in the hut and put the cow in the concrete stable!"

16. Assume that the price of the small tractor is \$4, the large \$6, and the wages of the driver \$2. The price of small tractors *in terms of large* is a ratio with small in the denominator and large in the numerator. Then we have:

	with driver	*without driver*
cost of large tractor :	\$ 6 + \$ 2 = \$ 8	\$ 6
cost of small tractor :	\$ 4 + \$ 2 = \$ 6	\$ 4
price of small divided by price of large :	$\frac{\$ 6 \;/\; 1 \text{ small}}{\$ 8 \;/\; 1 \text{ large}}$	$\frac{\$ 4 \;/\; 1 \text{ small}}{\$ 6 \;/\; 1 \text{ large}}$
price of small expressed in terms of large :	$\frac{6}{8}\frac{(1 \text{ large})}{(1 \text{ small})} = \frac{3}{4}$ large	$\frac{4}{6}\frac{(1 \text{ large})}{(1 \text{ small})} = \frac{2}{3}$ large.

with Greek agriculture: poor but efficient; or poor and inefficient.

International aid has concentrated on combatting poverty around the world by increasing the quantities of traditional factors of production and by introducing technological change. The results of international aid have varied throughout the whole spectrum—from resounding successes to miserable failures. I suggest that we might be better able to predict the results of future aid programs by first considering the question: "poor and inefficient" or "poor but efficient."[17]

The agricultural economy of Greece is poor. However, it has grown at the surprising average rate of 5 per cent per year in the postwar period! The agricultural economy of Greece is also efficient. Could it be that international assistance has paid handsome results in the Greek agriculture because of this efficiency?

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17. The successful verbiage of the question is due to T.W. Schultz [26].

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