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A PRODUCTION FUNCTION FOR EGYPTIAN AGRICULTURE 1913-1955

by

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I. STATEMENT OF THE PROBLEM:

A fundemental preliminary step in planning operations is the analytical study of the historical growth of the national economy. To be fruitful such a study should be capable of providing quantitative measures of the factors contributing to the growth of the economy in the past. The econometric approach proves to be valuable in this connection, and if data are available, it usually provides the required information in the shape of an economic model for the whole economy. For some time the present writer has been engaged with the problem of formulating and estimating such a model. It was believed that a first step towards the construction of an economic model describing the development of the Egyptian economy should be a study of agicultural production which remained up till now the principal economic activity in the country.

The purpose of this paper is to estimate the parameters of the so-called "agricultural production function", viz., the formula relating the volume of aggregate agicultural production to the factors of production used up in agiculture. The objective of such a formula is to estimate the net effect of each of these factors and its net contribution to production. For it is well-known that land, labour and capital in its various forms, all combine in some manner to yield agricultural production. But the question which still lacks a definite answer is: what is the effect on total production of a change in one of these factors? And what is the effect of a simultaneous change in some or all of them?

The correct answers to such questions are of paramount importance not only for scientific reasons, but also for practical problems,especially those arising in connection with planning . For any decision concerning the change in cultivated area, investment in agriculture, changes in the volume of employment, etc.., should be based upon reliable estimates of the effects of changes of these variables. Further, the econometric approach to the problem enables us to separate the "net" effects of these factors, and to measure them as they did exist in practice. This method would be superior to more common methods in which technical coefficients are obtained on some theoretical or empirical basis, measuring what "should be" under some ideal conditions. In fact, the comparison between what did happen and what should have happened under certain conditions would solve a great part of the planner's problem.

The present papar is an elaboration of a previous one by the same author(*) and should be considered only as a preliminary step towards a more systematic study of problems arising in the study of agricultural production. As many research papers, this one raises many questions beyond what it attempts to solve.It is with the hope that some of the fellow-researchers in the Institute would pay some consideration to these problems that I give this account of my study.

2. DEFINITION AND ESTIMATION OF VARIABLES:

The first step in econometric analysis, after the specification of the problem, is to define the variables which are to be included in the study. This has to be done with due regard to both theoretical and practical considerations. Then follows the process of actual estimation of these variables . This requires the determination of the"units" of measurement of the variables, and units of observation. Two major types of observational units can be identified in the present study: Either we choose the farm as a unit and fit our function so that it tells us something about the effects of changes in the size of the farm and other productive factors combined with it on production . Or, we consider the whole country as one big farm, and obtain enough observations on the working of that farm. In other words, we have to choose between the micro-approach and the macro-approach. In the latter case we have to obtain reasonably

(*) Cf. Memo. I52, N.P.C., 26/I/1959;

long time series for our variables rather than the so-called cross-sectional data. It is clear that practical considerations are in favour of the adoption of the latter course provided that sufficiently long time series can be obtained for the most important variables. It should be emphasised, however, that each of the above two approaches is capable of answering a different set of questions, although they have a lot in common. For practical reasons we have confined the present paper to the latter approach. It is hoped that the former one would be taken up later especially when the data of the last agricultural census are released.

Before discussing the process of estimating the relevant variables in detail, we shall discuss some problems of a general nature which would help to determine the scope and limits of the study. The first question to be raised here is the definition of what is meant by "agricultural production" : Is it meant to be net, i.e., comprising only the value added in agriculture, or global, i.e., covering the total value of all agricultural products. Further, what types of products should be included? To answer these and similar questions one has to analyze the production function itself. In general, this function is designed to explain the process of production rather than the creation of value added. Hence we have to obtain series of global production and not of value added. Further, production is conceived as a single process capable of producing a well-defined composite product. In other words, given a certain set of values of the factors of production, there should correspond a given amount of global product. This would ensure that our function is "single-valued" and thus subject to straightforward statistical methods of estimation.

One can generally distinguish between three main types of agricultural production: (1) farm products, (2) fruits and vegetables, and (3) animal products. The products within each group are, from the technical point of view, more homogeneous than as is the case between groups. It is proposed to concetrate here on the first of these groups, since they represent by far the most important part of total production, and they constitute the major and most systematic source of demand for cultivated land. Another point in favour of this choice is that the data for this group is more reliable, and one can construct rather long series dating as far back as 1913, without seriously running into the danger of wide changes in the degree of reliability of data. The crops included in this group are:

Cotton and cotton seeds, wheat, millet, maize, rice, beans, barley, lentils, helba, onions and sugar-cane.

This leaves out some minor crops which can be safely neglected, since their data are not available for the whole period. The only important exclusion is that of fodder (bersim) whose data started to become systematic only since the last war. However, there had been violent changes in the productivity of land from that crop, due perhaps to inaccurate reporting, as well as to changes in the period during which this crop is allowed to remain on land. In any case, the exclusion of this crop is not a serious problem as might be thought, since it constitutes a different type of product and cannot be considered as a cash product for the farmers.

In estimating the statistical series we have attempted to convert them into index numbers referred to a base equal to the average of the years 1950-1954, which is put equal to 1000 (simply to evade use of decimals) . This is considered more advisable than the use of a single year as base, since agricultural production is usually subject to violent year-to-year changes. The period chosen is one which is suitable as a basis for many economic series describing the development of other sectors of the economy. We turn now to a discussion of the main series.

i) <u>Acreage:</u>

As is well-known, the total cultivable area has remained practically constant since the second enhancement of the Asswan Dam(in 1933), at a level of about 8.3 feddans. No serious significance can be attached to changes in the series of cultivable area since there is a lot of ambiguity concerning what has been regarded as cultivable and what is not . On the other hand, the area actually cultivated showed rather minor fluctuations during the last forty years. In the inter-war period the average area cultivated annually was 5.39 feddans. It increases only by 4.7%, i.e., to 5.64 during the years 1951-1955, a difference which is about 8 times its standard error, showing a real increase. However, the average of the latter period is lower than the average for the years immediately following the war, viz., 5.79 m. feddans, a difference which is 5.73 times its standard error, showing a sighnificant drop. As will be shown later there are enough reasons to suspect the validity of such changes.

But when one comes to the problem of defining the unit of measurement of acreage, one easily sees that the absolute area unit is not a suitable one. In fact the time rate of exploitation renders such a unit nonhomogeneous. A feddan which is cultivated all-over the year certainly has a greater chance to contribute more to agricultural production, than one which has been allowed to remain idle for a few months. What is relevant here is not the area units, but the productive units.

Another series published annually is the so-called crop area, whose unit is a feddan-crop. Thus a feddan which is cultivated twice during the same year is counted as two feddans, irrespective of the period of cultivation. Again it is clear that such a treatment does not ensure homogeneity. Thus an apparent increase could take place if we substitute for a lengthy crop, four or five short-lived crops occupying the land for the same period.

The problem is quite similar to that faced in the measurement of the labour input. Apart from problems of productivity, the labour input is usually considered in terms of man / year rather than in absolute number or man/product. Therefore it has been decided to use a feddan/year unit, so that the resulting acreage would show a stable rate of exploitation . Thus if a feddan is cultivated with a certain crop which remains one year it can be treated as a complete feddan, while if the crop lasts only half a year it would be considered as half a feddan only. This treatment should not be considered in any normative sense. It is merely a simple correction which takes care of the corrections meant by introducing the crop area concept but at the same time excludes the disadvantage of treating a feddan cultivated for 9 months with cotton as equivalent to a feddan which is cultivated with vegetable for one month or a fraction therefrom. Our concept is not a traditional one, and many agronomists have objected to it in favour of the crop area concept. However, if we leave traditions aside, it can be seen that this concept is more logical since if a certain crop is capable of engaging land for 12 months, this should not mean a reduction of the usage of land simply because each feddan cannot be counted more than once on a crop area basis.

The main difficulty is that the actual period during which a certain crop lasts on land might change from one region to another and from one year to another since it might differ within limited ranges owing to climatic conditions, and no records exist on this point. However, since these differences are rather of a random nature, they can be neglected and they would be incorporated in the residual errors of the equation.(*) Accordingly we have decided to use the following average periods for all years under discussion:

Sugar-cane	12 months
cotton	9 months
wheat, helba	7.5 months
rice, barley	6.5 months
lentils	6 months
others	5.5 months

These are rough estimates which were chosen after consultation with some colleagues. They have been all transformed into fractions of a year, and the area cultivated by each crop has been multiplied by the corresponding fraction to obtain the feddan/years engaged by that crop in a given year. The sumtotal of these products gives the total feddan/years which have been allocated to the given set of crops. It is clear that this treatment would help to account for the fact that we are considering only part of the crops for which the

(*) This might raise difficulties in the process of estimating the parameters, owing to the dependence of residuals on the independent variables.

land has been used . We shall call the resulting area, the "exploitation area" to differentiate it from the cultivated and the crop areas.

We can then define the time rate of exploitation as follows:

$$\text{time rate of exploitation} = \frac{\text{exploitation area}}{\text{cultivated area}}$$

It was found that this rate was practically constant all over the whole period at an average of 0.7 years for each feddan. In other words the allocation of crops to land was such that each feddan was occupied about 8.4 months and left idle for the rest of the year, on the average. The averages over the inter-war and post-war periods were as follows :

period	cultivated area (m. feddan)	exploitation area (m. feddan/year)	rate of explotation
1919-38	5.389	3.795	0.704
1946-50	5.790	3.807	0.658
1951-55	5.644	3.849	0.700

Although the last period shows an increase in the exploitation area of about 4.1% over the first, the rate of exploitation seems to have declined slightly. In fact it can be seen that the exploitation area has reached a peak in 1929-1930 at which time the rate of exploitation amounted to 0.733, which was the maximum for the whole period. It seems that the drop experienced by the remainder of the period is due to the introduction of restrictions on the cotton area .

Referring to Table (I) we notice that the exploitation area had been (unlike the cultivated area) slightly affected by the first world war. Afterwards, it grew at a rate faster than of the cultivated area. This rate which amounted to about 1.4% annually, was suspended at the beginning of the great depression. Both area declined and the decline in the exploitation area was somewhat stronger . The 1929 peak could not be regained before 1957, in spite of the additions to the cultivated area .It is worth noticing here that the cultivated area showed a jump of some 400 thousand feddans between the two years 1943,1944 without any corresponding increase in the exploitation area . This might be largely due to changes in the system of estimating cultivated area.

ii) Labour:

Ideally the factor labour should be estimated in terms of man/months actually employed in agriculture , and technically necessary. This raises many difficulties which were not easy to solve. First of all the man /hour or man/month concept is rather ambiguous in agriculture, and it is difficult to consider a worker as necessary or redundant when is simply keeping an eye and waiting for the season to resume his work. At times he might be apparently idle, but this does not necessarily mean that he can be dispensed with for ever.Further at seasons many members of the farmer's family might be occupied (especially children) in some sort of a seasonal employment. The problem is made more difficult by the fact that the agricultural labour is neither organised nor necessarily contractual. Some writers are inclined to use given technical labour coefficients for the various crops, and thus consider labour requirements in terms of some constant productivity man/month concept. Thus the Planning Committee considers the number of those actually employed in agriculture in 1959/60 as 4.22 millions, out of which 3.245 only are technically required.

However, this treatment begs the problem since it is based on certain implicit assumptions as regards the virtual requirements according to the given point on the production surface, and any dhanges that may occur in productivity. We might be therefore content with a concept based on the number of workers actually living directly upon agricultural activity. If for a limited area there occurs an increase in the numbers drawing their living from agriculture, this would be reflected in a deterioration in their average and marginal productivities . We prefer to adopt this appproarch and see its implications to the changes in productivity, rather than assuming something about this latter which would immediately restrict the information that can be derived from the production function itself. Thus we shall be adopting a supply rather than a demand concept. Our estimate is of the labour force rather than of actual employment. But this raises another question, namely of obtaining an annual series of the agricultural labour force.

The main source of data on those engaged in cultivation of land is the population census (part of Part I in the classification by economic activity). This can be supplemented by the early manpower sample surveys of 1958, which are based on the population census conceptual framework. Another source is the agricultural census, but it could be easily reconciled with the population census statistics. Thus we accepted as basis for estimating the labour series, the decennial figures derived from the population censuses and the manpower sample surveys. The annual series was derived by means of an auxiliary series, viz. , the rural population. Thus the ratio of agricultural labour to rural population in the census years are calculated. The intercensus ratios were then estimated by means of graphical interpolation. The reliability of such a method depends on the reliability of the assumption that the annual changes in the agricultural labour are highly correlated with the annual changes in rural population which is the main source of this sort of labour.

However, this procedure raised another problem, namely the estimation of the rural population itself. Again we had to introduce some assumptions here. The first is that the changes in this type of population are primarily due to the natural increase in the rural areas. These were derived from the the registration data published annually in the Statistical Abstract. There remains the effects of internal emigration, which were assumed to occur smoothly between any two consecutive censuses. Thus we extrapolate the rural population beyond a given census until we obtain an estimate for the following census year. The actual estimate for this latter year is then used as a basis for correcting the intervening years , by means of simple interpolation.

The resulting estimates of the ratio of rural to total population are given in column 10 of Table (I) . It should be remembered that the term rural is not always an unequivocal one . But what matters for our purpose is to use it in a consistent manner, which was the case. It might be observed that this series has showed a persistent tendency towards falling down, especially in more recent years.

In this process we had to construct a series for total population which is shown in column (5) of table (I) in the form of an index number referred to the same base period as that chosen for other series. It was found that the the ratio of agricultural labour to total population was I7.9% in the base - period. The product of the ratio of rural population into that of agricultural labour to rural population gives a series of the ratio of agricultural labour to total population. This series has been converted into an index number which is shown in column (9) of table (I) . It can be seen from this index that the ratio has been grdually increasing up till I933 , then it started to fall down especially since the beginning of the second world war. This led to a rapid increase in the absolute number of labour during the first twenty years, followed by a deceleration of this increase and the series became eventually practically stationary.

iii) Capital and other factors:

The next main factor is fixed capital. Owing to the fact that mechanisation has not been seriously contemplated in Egyptian agricuture one can safely neglect change in agricultural machinery over the period under consideration . If there had been any changes in this factor they can be incorporated in a trend term, as being gradual and smooth over time.

However, a large amount of investments in agriculture are of the indirect nature through investments in irrigation . Their indirect nature raises some problems concerning the determination of their impact on agricultural production, and the method of capitalization . One should also differentiate between two types of investments here, viz., public investments in dams, canals and drainages , and private investments in field canals and wells. Their impacts on agriculture would be through the supply of water , and its allocation to various parts of the cultivated land. An indicator for the first factor might be the length of canals and drains. However. this is not a very reliable indicator, since what is really relevant is the amount of water which can be virtually supplied by these waterways. The problem of allocation is the more important one.

A little reflection shows that the main contribution of these investments is in the determination of the total cultivated area, and in the possibility of cultivating it a longer fraction of the year . Both factors are taken care of by the exploitation area as defined before, since any increase in area or elongation in the period of cultivation will be reflected in the totality of feddan/years in so far as they relate to the specific use of land for the cultivation of the group of products under study. The quality aspect of the changes in crops will be considered later under the factor "allocation" . However, a good part of the effects of field waterways goes to restoring the productive capacity of the fields. In that sense it can be considered as area replacement, keeping land intact at some level of productivity allover the period, In other words, a large part of such investments can be regarded as gross investments which would be excluded if we attempt to obtain their time integral on a net basis. Any improvement over and above replacement requir~~m~~ements would be incorporated in the catch-all trend term.

However, this would leave the problem of water supply standing. It has been decided to pay some attention to this factor since its annual changes are supposed to contribute to short-run variations in agricultural production. Our measure of this factor takes the shape of the amount of water released at the Asswan Dam annually. This might be a rather ambiguous concept since an excess of water is as bad as a shortage . The factor works in a nonlinear manner, and it might be that deviations from a certain optimum can be a better indicator. This problem still needs more serious consideration. We shall leave it here at that state.

Consider now the working capital . We notice that there is usually some more or less fixed proportionality between this factor (especially seeds) and production. However, this cannot be easily assumed when crops differ from year to in an aggregative function. If we succeed in eliminating the effects of changes in crop-composition we can safely assume a simple proprtionality between this type of working capital and global production.

There remain some other items which reflect radical changes in agicultural technology. The most important of these is fertilizers which are considered to have undergone some appreciable change in their use over the period under consideration. It is true that part of the fertilizers used is meant to restore the fertility of land, while the rest goes to a real improvement of productivity, at least up to a point. This however, raises the difficult problem of the interaction between type of fertlizer and type of product. Part of the fertlizers used are home made and they are to a great deal composed of natural manures. For this latter scanty statistics exist, and we were compelled to ignore them. The series used in this study is an index number of chemical fertlizers, whether domestic or imported. Each type of fertlizers had been transfromed into its equivalent of phosphates or nitrogen, before their aggregation into the general index. However, this index represents the supply rather than the actual use of fertlizers.

The exclusion of natural manures raises some difficulty. Their proportion to total fertilizers tended to decline over time . This means that the effect of fertlizers as measured by chemicals only would be smaller than its true value, since their rapid increase would be partly compensated by the decline in manures. However, the coefficient would be still meaningful for projections if it can be assumed that the trends in both types of fertlizers would persist in the same manner in the future . Further investigation would be needed to assess the net effect of each type.

iv) Global production:

There remains now the problem of measuring global production. This is in fact a problem in index number construction. Let us use the following system of notation:

Ordinary symbols denote base year magnitudes, while primed ones stand for year of copmarison. The subscript r stands for crop.

A_r the r-th crop area (in fedden/year)

V_r Average product per feddan /year (in ardebs or cantars)

Q_r Total production, volume (in same units)

P_r Unit value (in piastres)

M_r Money value of crop

Summation signs will run over subscipt r.

For indices of total value, quantity and prices we shall use the corresponding symbols: V, Q & P.

There shall be two indices for area: A & B as defined later. For any product r, we have the following identities:

$$Q_r = A_r \cdot V_r \, , \qquad M_r = Q_r \cdot P_r \qquad (1)$$

Similar relation can be formed for current years. In the following discussiân we shall drop the subscript r since the summation sign would indicate its presence wherever it should have appeared.

The most straightforward index to obtain is that of money value:

$$M = \frac{\Sigma M'}{\Sigma M} = \frac{\Sigma Q'P'}{\Sigma QP} \qquad (2)$$

This can be rewritten as follows:

$$M = \frac{\Sigma Q'P'}{\Sigma QP'} \cdot \frac{\Sigma QP'}{\Sigma QP} \qquad \text{or,} \qquad M = \frac{\Sigma Q'P'}{\Sigma Q'P} \cdot \frac{\Sigma Q'P}{\Sigma QP}$$

multiplying both numerator and denominator by the same magnitude.

The product of these two expressions gives:

$$M^2 = \frac{\Sigma Q'P'}{\Sigma QP'} \cdot \frac{\Sigma QP'}{\Sigma QP} \cdot \frac{\Sigma Q'P'}{\Sigma Q'P} \cdot \frac{\Sigma Q'P}{\Sigma QP}$$

Taking square roots and rearranging the factors, we obtain:

$$M = Q.P \qquad (3)$$

where,

$$Q = \sqrt{\frac{\Sigma Q'P'}{\Sigma QP'} \cdot \frac{\Sigma Q'P}{\Sigma QP}} \qquad (4)$$

$$P = \sqrt{\frac{\Sigma Q'P'}{\Sigma Q'P} \cdot \frac{\Sigma QP'}{\Sigma QP}} \qquad (5)$$

which are the ideal-index formulae for quantities and prices respectively. These are well-known results in index number theory, and they help to illustrate the system of thinking in the rest of the problem.

Thus we have obtained indices of money value, quantity and prices, and obtained a relation among them quite similar to the second of relations (I) which holds for a single product . We try now to construct a similar relation to the first of those relations, viz., one connecting quantity, area and productiviy. Now substituting for the Q's from (I) in (4) , we find that:

$$Q^2 = \frac{\Sigma A'V'P'}{\Sigma AVP'} \cdot \frac{\Sigma A'V'P}{\Sigma AVP} \qquad (4')$$

We want to obtain a relation similar to that for individual crops:

$$Q = B.V \qquad (6)$$

where B is an index of total area, while V is an index of overall average productivity. Let us rewrite (4') by multiplying both denominator and numerator by the same quantities:

$$Q^2 = \left(\frac{\Sigma A'V'P'}{\Sigma AV'P'} \cdot \frac{\Sigma AV'P'}{\Sigma AVP'}\right) \cdot \left(\frac{\Sigma A'V'P}{\Sigma AV'P} \cdot \frac{\Sigma AV'P}{\Sigma AVP}\right)$$

$$\text{or, } Q^2 = \left(\frac{\Sigma A'V'P'}{\Sigma A'VP'} \cdot \frac{\Sigma A'VP'}{\Sigma AVP'}\right) \cdot \left(\frac{\Sigma A'V'P}{\Sigma A'VP} \cdot \frac{\Sigma A'VP}{\Sigma AVP}\right)$$

In the first expression, the first and third factors can be considered as indices of area, the weights being V'P' and V'P respectively. The second and fourth factors are indices of average productivity, the weights being AP' and AP respectively. In the same manner we can factorize the second expression into indices of average productivity (with weights A'P' , and A'P) and of area (with weights VP' and VP) . If we multiply the two expressions together we obtain an expression for Q^4 , which can be factorized into two factors: the first being the product of four indices of area and the second is the product of four indices of average productivity. Taking the fourth root we can write these indices as follows:

$$B = \sqrt[4]{\frac{\Sigma A'V'P'}{\Sigma AV'P'} \cdot \frac{\Sigma A'V'P}{\Sigma AV'P} \cdot \frac{\Sigma A'VP'}{\Sigma AVP'} \cdot \frac{\Sigma A'VP}{\Sigma AVP}} \qquad (7)$$

$$V = \sqrt[4]{\frac{\Sigma A'V'P'}{\Sigma A'VP'} \cdot \frac{\Sigma A'V'P}{\Sigma A'VP} \cdot \frac{\Sigma AV'P'}{\Sigma AVP'} \cdot \frac{\Sigma AV'P}{\Sigma AVP}} \qquad (8)$$

The index V is the one which can be constructed for average product in a manner which fulfills the conditions of the ideal index formula with respect to the volume index Q as defined by (4) . It might be mentioned here that if A_r is measured in terms of feddan years, then V_r should be corrected correspondingly, so that their product is still Q_r as in (1) . Since the time factor for each crop is assumed to be constant allover the period , the index V will have the same value in either case .

Similafly the index B would attain the same value in both cases. Here the area is weighted with weights which are proportionate to the value of its product. Thus if a feddan is used in a crop which produces a more valuable product, it would be given more weight in the index. Total area may remain constant from one year to another, but nevertheless the index might be greater or smaller than one, according to the <u>allocation</u> of land to the different crops. This means that the index can exceed unity for one or both reasons:

(1) An increase in total areas in terms of feddans (or feddan/ years)
(2) An increase in the capability of land by allocating to it more valuable crops.;

The first of these can be called the "<u>absolute area factor</u>" , while the second can be called the " <u>crop allocation factor</u> ". Now the absolute area index can be constructed in a simple manner owing to the additivity property of feddans or feddan/years. It is:

$$A = \frac{\Sigma A'}{\Sigma A} \qquad (9)$$

Denoting the relative share of the r-th crop in land by X_r , then

$$X_r = A_r/ (\Sigma A_r) , \qquad X'_r = A'_r (\Sigma A'_r) \qquad (10)$$

Thus if we divide each numerator in (7) by $\Sigma A'$ and each denominator by ΣA, we obtain an index for the X's, which has to be multiplied by the index A, to restore B. Thus:

$$B = X.A \qquad (11)$$

X being the crop allocation index . Substituting in (6) , we obtain:

$$Q = X.A.V \qquad (12)$$

Reversing the argument we can define a new index of quantity which is free from the allocation factor, Y say,

$$Y = A.V \qquad Q = X.Y \qquad (13)$$

The index Y is the analogue of Q_r, the quantity in the single - product case , while the index Q contains something more. This is a familiar complication in the process of aggregation of economic variables. The index Y can be regarded as an index of a homogeneous composite product, and it would be the more appropriate index for the purposes of the production function, provided that the use of factors is not affected by the allocation factor. Allocation itself has to be explained in terms of other factors. Not only tchnical data are relevant here, but also market conditions are importtant . Analysis of this problem would carry us far from the purpose of the present study.

It might be also mentioned that allocation has also its geographical aspect . Suppose that total area remained constant, and so remained the relative shares of the various crops. Further let us assume that the average productivities remained constant in terms of all crops for each piece of land , i.e. , if each given feddan has been allocated to the same crop, we could have obtained the same product.It may happenthat in one year certain areas are allocated to a given crop, while in the other other areas are allocated to it. If it happens that the area allocated in either year is more suitable for that crop, the index will vary from unity. If we do not allow for this factor also, the index V would be affected, and hence Y. We might expect this to occur for example in the years of restriction vs. unrestricted years. This means that we have to form an index similar to X to account for this factor. The time given to this study did not enable us to go into the necessary details of such an index. It is hoped to be the subject of another study.

The basic data used in the calculation of these indices are given in Tables (II)-(VI), in the appendix. The indices themselves are given in Table (VIII). The source of data are the Annual Statistical Abstracts. The prices quoted there are the prices quoted for each crop during the years of consumption rather than years of production.It is not clear whether these prices are really farm prices or wholesale prices. In any case we are interested in yearly changes,and we can safely assume that these sets of prices are capable of measuring these changes.

3 -General Remarks on the Series:

In studyin flong series of the type given before , it is perhaps more meaningful to convert the data into per capita terms. The index of population has shown an increase of about 80% over the whole period. On the other hand cultivated and exploitation areas have shown little improvement, if any . As a result the period witnessed a rapid fall in per capita shares of cultivated land, which fell down from 0.43 feddan to less than 0.25 feddan . If the per capita share of land should have retained its initial level, the cultivated area should have risen to about 9.84 million feddans by the end of period, an amount which exceeds total cultivable area by about I.5 million feddans. The same applies also to the exloitation area, since the per capita share which remained for some time roughly constant, started to fall down at a steady rate since the early thirties.

It is clear that the present rate of population growth which amounts to about 2.5% would only help to aggravate an already serious situation . In the most densely populated European countries (e.g., Holland, Belgium, Western Germany) the per capita share is now well above 0.5 feddans, it reaches about 0.9 feddan in Britain, 3.8 in the U.S.S.R . and 4 in the U.S.A . Both horizontal and vertical expansions are a must .

Figure (1) illustrates the above mentioned facts. It should be mentioned, however, that the relative positions of the indices of population and area are arbitrary, since we have put all indices equal to I00 in the same base period (1950 - 54). What matters is the relative rates of change exhibited by the curves. It can be seen that there is a tendency for the absolute rate of population increase to be accelerated, a fact which applies to the relative rate of growth which nearly doubled over the period . The exploitation area has shown a stronger rate of growth in the early part of the period up till I929 as mentioned before. On the other hand the jump which had been observed in the cultivated area (and suspected to be due to the system of reporting) has been corrected in I95I . Apart from that the series moved closely togethersince

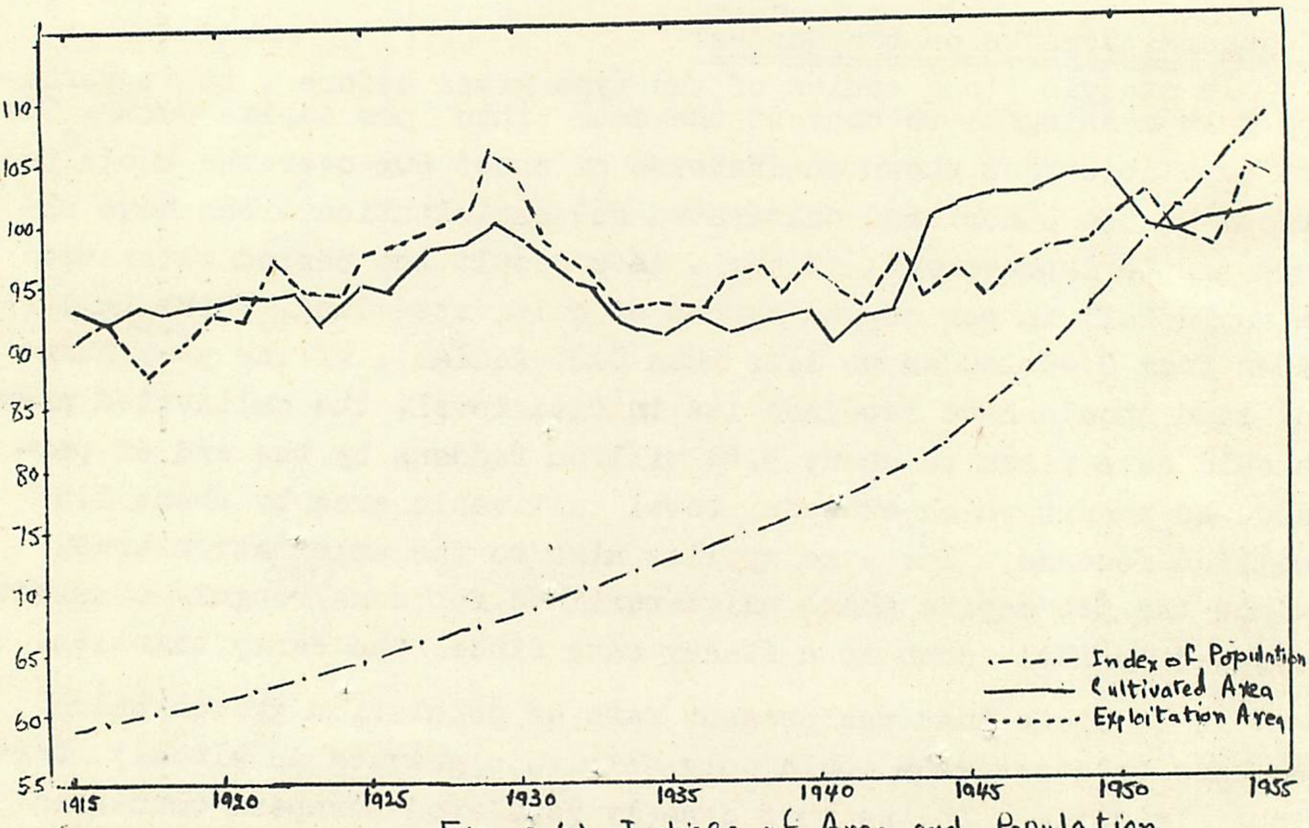

Figure (1) Indices of Area and Population

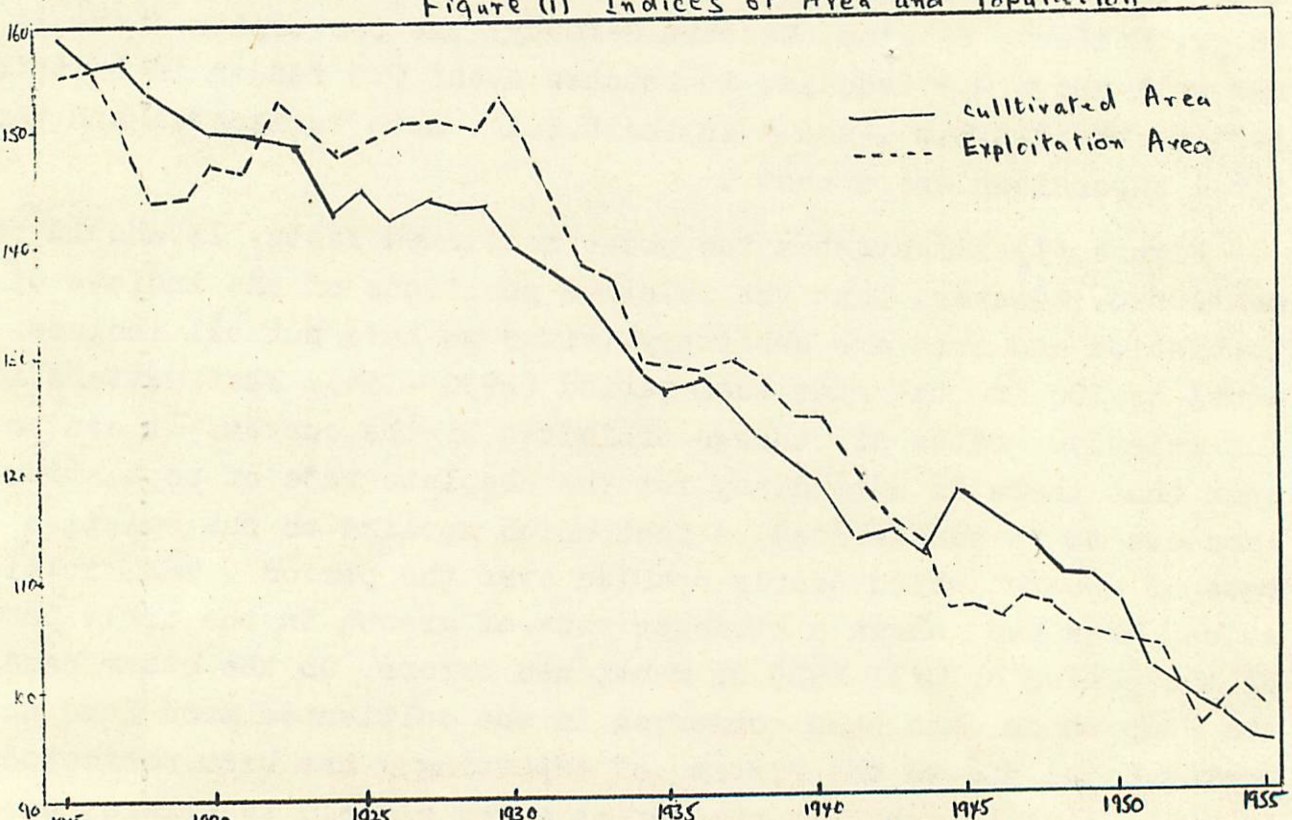

Figure (2) Indices of per capita Areas.

the thirties, with a tendency on behalf of the exploitation area to fall above the cultivated area. Extrapolation of the series beyond the period would bring about more divergence between population and area, unless something radical is done to the latter.

The outcome of these comparisons in terms of per capita shares is illutrated by Figure (2). Per capita shares of cultivated area follow a somewhat decreasing smooth trend (apart from interruption of the period 1943 - 1951) . This downward trend is exhibited by the exploitation area apart from the pre-thirties period, when the decline had been withheld by the tendency of this area to increase somewhat rapidly. These observations show that the agricultural system (with regards to the types of crops included) has been undergoing some changes until it settled down at some more or less traditional path since the early thirties. On the other hand some of the irregularities reflected by the reportings of the cultivated area seem to be superfulous especially when compared with the exploitation area and the general trend of the series itself. This gives us more confidence in using the exploitation rather than the cultivated area in our study.

The second factor affecting total production, besides total area and its exploitation, is average productivity per feddan. Figure (3) shows that average productivity has declined during world war I, then went on increasing until 1939 . The big push which has been experienced during the thirties is explained by some experts on the basis of the improvements which have taken place in irrigation and drainage, especially the latter. Again the war effect has been strongly reflected during the forties, due to the lack of fertilizers in particular. The reflation which has taken place in average productivity raised it to 104% in the end of the period as compared with the 110% already achieved in 1938 (trend value). This means that there is much room for expansion in this direction.

It is clear that the alluded to concept of productivity is an over-all one which is the summary result of productivities with respect to various crops. Table (VII) summarizes average feddan productivities in the different crops during periods of five years, or in homogeneous periods, e.g., the war period . These averages have been transformed into index numbers on the base 1950 - 54 (whose actual averages are given in the same table) . Comparing the last of periods (1955-57) with the base period, we notice that some crops have suffered from a decrease, viz., cotton, onions and lentiles. All other crops - except maize - have enjoyed an increase, thus leading to an overall increase of about 2% . However, if we measure these changes in terms of their standard errors, i.e. , in terms of the changes which would have resulted accidentally (as usually happens from one years to another) we find that the only significant changes are increases for rice, wheat, barley, sugar-cane and helba. The increase in rice produtivity is the most significant one owing to the recent interest in this crop and its brands .

If we compare the same peiod (1955-57) with the highest one, 1935 -39 which showed 9 point increase in the general average over the base - year average, we notice that significant falls have eccured in cotton, maize, onions and lentiles. Insignificant drops occured in millet and beans. For the remaining crops there were real increases. However, the decreases were so pronounced that the overall average fell by about 7% . It is clear that these changes in productivities reflect both the change in produtivity in general plus the effect of the allocation of the proper land to the proper crop.The former is due to the system of agriculture itself, and use of more inputs leading to the increased fertlity. However, one should be aware always of the fact that these aggregative estimates are necessarily affected by hidden qualitative changes. For example, the fact that cotton is not a simple crop might call for the elimination of the effects of changes in brands before generalizing any conclusions with respect to the fertility of land itself. This ambiguity in the interpretation of the term "average productivity" is no peculiear phenomenon in our study. Attemps to explain it should be always based on technical considerations which carry us far from the core of the present study. In the same diagram(Fig.3)we have drawn the curve showing the changes in the share of feddan/year from labour. It is interesting to notice that changes in average productivity have been accompanied by rather similar changes in per feddan labour. This might be taken as an indication that not necessarily all labour employed in agriculture is underemployed. The improvements in the techniques of production seemed to be capable of sustaining more workers for the purposes of more intensive cultivation. However, it should not be concluded from this simple comparison that labour would be a significant variable in explaining changes in production. This result should wait for the more elaborate study of the agricultural production function itself.

Going back to the average productivity curve, we observe a slight upward trend of about 0.45% annually (relative to the base level of 50 -54), apart from the period 1933-45 . During the first part of this latter period rapid increases occured in the average productivities for all crops. This seems to be due to many factors: the second enhancement of the Asswan Dam, in 1933, the use of more fertilizers,(see Table VIII), the improvements of seeds, etc.. In the second part the War sweapt off all these improvements, especially because of the shortage in fertlizers. This shows that many of the projects oriented towards increasing these items which fall under the heading of working capital are in fact of the land-preservation type. They need not increase productivity (at least up to a point), but their absence would be reflected in a rapid deterioration of productivity. This problem, obvious as it might be, is rather a serious one,especially when assessing the future increases in agricultural production according to the agricultural plan. One can easily slip into the error of calculating the effects of these elements as net effects, while gross they are. In other words, if we consider fertilizers as leading to increases in production, we should discount that amount of fertilizers which is just necessary to keep the level of production at its previous standard . This problem is well-known in agricultural experiments, but there exists some doubt in generalizing the results of these experiments to a dynamic situation. It might be also that the cumulative effects rather than the spontaneous effects

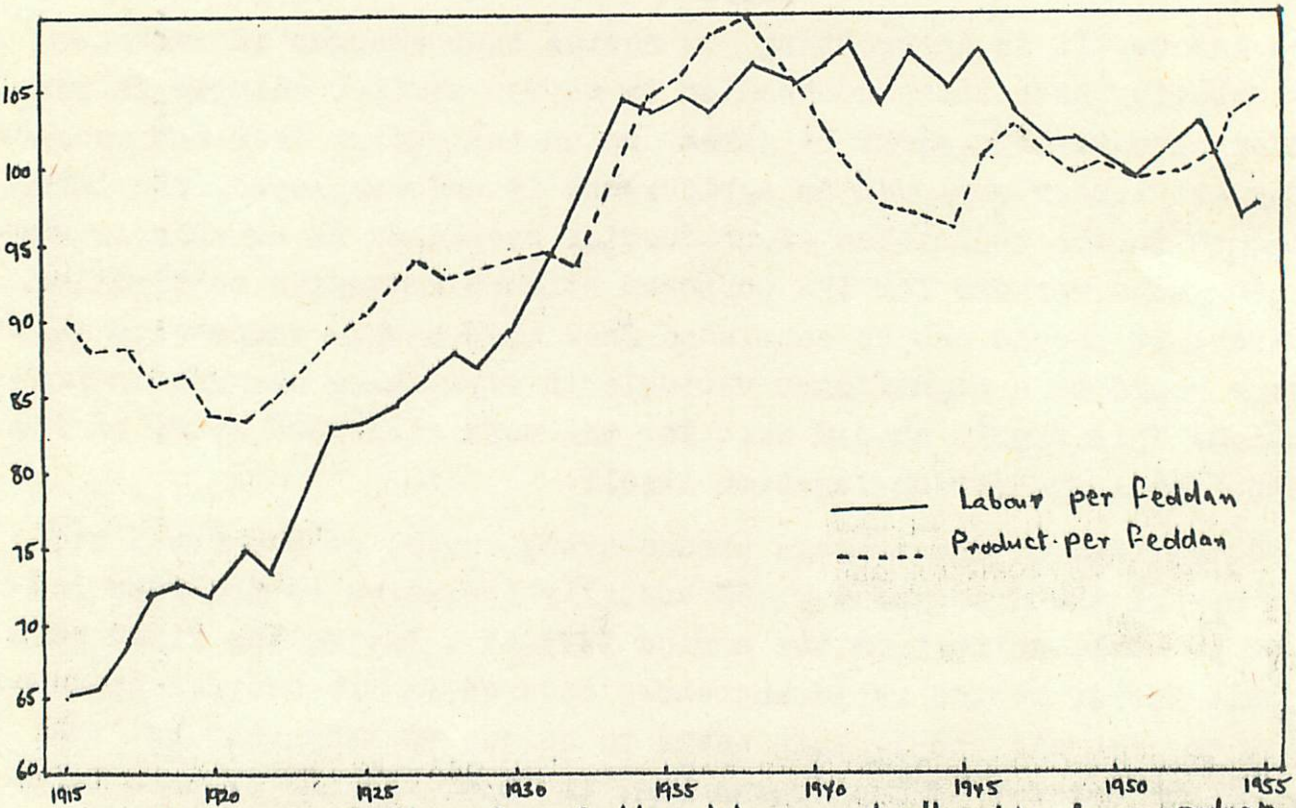

Figure (3). Indices of per feddan labour and allocation free product

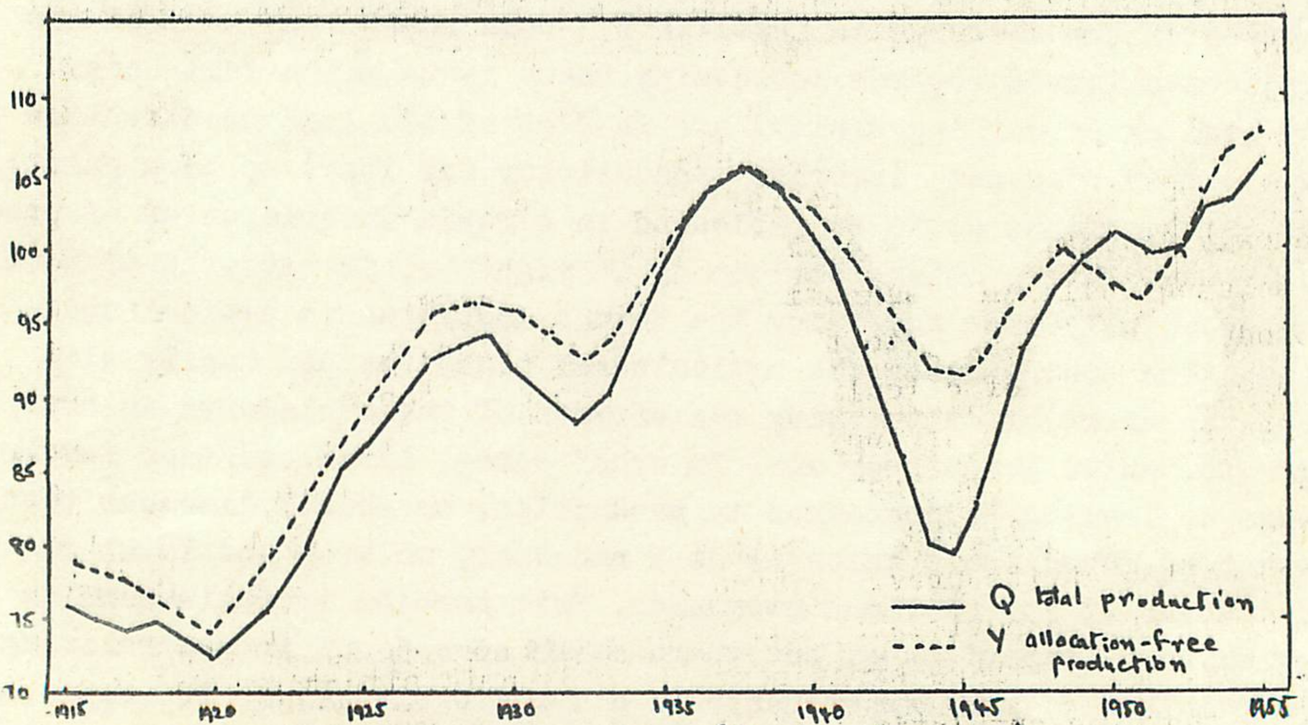

Figure (4) Indices of Production (Moving Averages) are those which count.

The production series Q has been found subject to a short cycle of about four years length. To get rid of this cycle we have computed centralised four-years moving averages, and the result is represented in Table (IX) and graph (4). This helps incidentally to free the series from a good deal of the accidental variations. The series for production net of the allocation factor is treated in a similar manner and it is illustrated in the same diagram. It can be seen that production had suffered from large reductions during the depression and the two world wars. The reduction which occured during the last war was so severe that production could not resume its prewar level until the end of the period. On the other hand, apart from a few points, the allocation-free index was above the actual production index. This means that in rare cases better allocation of land was achieved than that of the base period . The widest gap between the two curves is that which occured during the second world war. During that period crop restrictions had been introduced to face a difficult external trade position, irrespective of the technical conditions of production. This was reflected in a drop in the actual index far below that in the allocation-free index. This means that had we not reallocated land during that period in the manner which has virtually taken place , the drop in production would not have been as severe as it had been . The drop in the allocation free index is the one which can be really attributed to a real deterioration in production conditions.

However, this might be putting the problem in stronger terms than could be really warranted by facts . It should be always remembered that the underlying assumption in such and similar statements is that of homogeneous land, i.e. , of equal productivity in a given year which differs from that of another year. It might be that the overall average of productivity in a given year is itself a decreasing functing of the area cultivated by a given crop. For example one can argue that the observed increase in average productivity of cotton during the forties is to some extent due to the fact that the area allocted to cotton had been 69% of that allocated to it in the period. This means that about one third of the land had been withdrawn, and in doing that the least suitable land was shifted to other crops, so that maximum output could be obtained from the restricted area. In other words, when the area of a certain crop is expanded submarginal lands are introduced with the result that the overall average is reduced .It remains however to prove that the land thus withdrawn is again submarginal with respect to the replacing crop. This is a point to be studied and we might refer here to what had been mentioned before, namely, that allocation should be also stuied in a regional sense, If the above contention turns to be true, our allocation factor would be over-estimated . However, since there is no reason to accept either assumption, we might conclude that the shift of land from one crop to another would affect the general productivity index to the same amount roughly if the general tendency had been always to realize some sort of an optimum allocation. Optimality is usually assumed under a certain market structure if restriction are not artificially introduced. The problem has undoubtedly to be subjected to more careful study.

Under these conditions we can deduce from the series of the allocation factor that the war-time restrictions had led to a drop in production of about 15% than could have been under the base period conditions .Another 10% had been lost through a real reduction in average productivity. In any case the rise in production which tended to take place up till 1938 , had been suspended and there is a good deal to be done before we can resume this past trend.

Considering now the series on a per capita basis , Figure (5) shows a rather unpleasant story. Ignoring accidental variations, and the more pronounced effects of the wars and the depression, it can be seen that per capita shares tended to increase on the average by about 0.6% annually up to the beginning of the second war. As a result of the severe drop in total production during the war, followed by an acceleration of population growth owing to the drop in the crude death rate after the war, per capita shares fell to hitherto

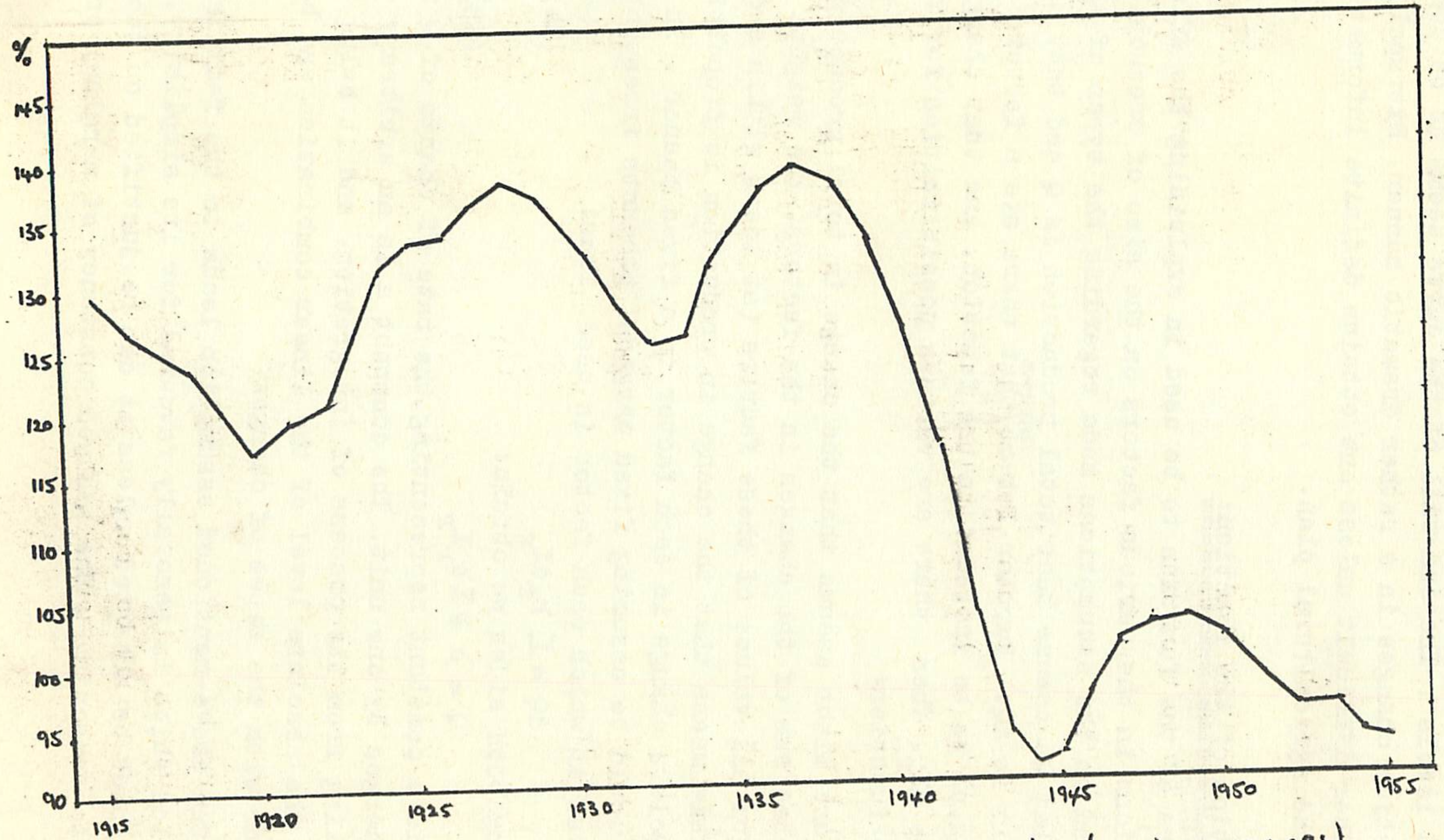

Figure (5) Index of per capita share from total production (moving averages)

1950-1954 = 100%

unwittnessed levels . The end-tail of the curve seems to be dominaed by population changes in a rather dramatic manner. Extrapolation would be rather difficult unless one obtains definite information as regards the agricultural plan.

4. Formulation of the function:

The form of the function to be used in explaining the effects the variations in the various factors on the size of production would depend on the assumptions made regarding the types of these effects . Let us assume that total production is Q and that a small change in it is dQ. Further let us assume that there are n factors X_r ($r= 1,2,\ldots,n$) to be included in the function, and that changes therein are dX_r. Then there are various possiblitities for formulating the function:

(1) First one might assume that the change in total production is the weighted sum of the changes in the factors, the weights being constant for all values of these factors (at least within a certain range). This means that the change in production is proportionate to the absolute change in each factor in a fixed manner . In other words, we would be assuming fixed marginal products irrespective of the level at which each factor is used. Thus:

$$dQ = \sum b_r dX_r \tag{14}$$

Integrating both sides we obtain:

$$Q = a + \sum b_r X_r \tag{15}$$

where b_r is a constant representing the rate of change of Q whenever X_r changes by one unit. The constant a is an arbitrary constant resulting from the process of integration, and it helps to detemine the absolute level of the linear combination and has nothing to do with the rates of changes

Thus the above-mentioned assumption leads to the familiar linear function which is generally favoured for its simplicity. However, it cannot be accepted unless it can be justified on the basis of economic reasoning . The assumed constancy of marginal products is in contradiction with the generally accepted proposition of diminishing returns in agriculture. It is to be expected that constant additions to the amounts used from one factor -keeping the others constant -lead to increases in total production which eventually diminish systematically. Total production would be increasing at a decreasing rate. Therefore we had to look for a more reasonable assumption.

(2) The second assumption would be therefore, that the rates of change are inversely related to the levels at which the factors are used. This can be realized by a formula stating that the absolute change in production is in fixed proportionality to the relative changes in the factors. Thus:

$$dQ = \sum b_r \,(dX_r/X_r) \tag{16}$$

and on integration:

$$Q = a + \sum b_r \log X_r \tag{17}$$

Here again a and b_r are constants, though differing from those in (15) b_r would be the absolute change in Q resulting from changing X_r by 1% rather than by one absolute unit. At a lower level of X_r this change would be small, while at a higher level it would be large in absolute value. This ensures the fulfillment of the assumption, though in a specific manner. This should not exclude other formulation specifying the manner in which the diminishing returns can occur.

(3) Let us assume for example that it is the relative rather than the absolute change in Q which is proportionate to the relative changes in the factors. If we express this by:

$$dQ/Q = \sum b_r \,(dX_r/X_r) \tag{18}$$

the function would become:

$$\log Q = a + \sum b_r \log X_r \tag{19}$$

...ems more acceptable both on theoretical and practical grounds.

To illustrate the implications of the above assumptions, let us assume that only two factors are used , say A= acreage, and L = labbour. We denote the coefficient of A by b and that of L by c. Thus the three equations would be:

$$Q = a_1 + b_1 A + c_1 L \tag{20}$$

$$Q = a_2 + b_2 \log + c_2 \log L \tag{21}$$

$$\log Q = a' + b' \log A + c \log L \tag{22}$$

where logarithms are taken with respect to the base e. We have added the subscripts 1 and 2 in the first two equations to differetiate the coefficients from those in the third. If we further assume that

$$a' = \log_e a$$

equation (22) can be also written as:

$$Q = a\, A^b L^c \tag{23}$$

This form is familiar in the theory of production functions and is named after Cobb and Douglas who first suggested its use in the study of American industrial production.

It is clear that (20) implies constant marginal products for both area and labour for all levels of production, which is not realistic. Equation (21) assumes decreasing average and marginal products which is more realistc. Thus the marginal product of labour is:

$$\frac{dQ}{dL} = c_1/L$$

which, with a constant c_1, decreases as L increases. Further, the average product is:

$$\frac{Q}{L} = \frac{a_2 + b_2 \log A}{L} + \frac{c_2 \log L}{L}$$

Holding A constant, the first term would decrease as L increases. Further, with a constant c_2, the second term would be also decreasing since log L increases more slowly than L itself.

For equation (22) or its equivalent (23), we notice that the average product is:

$$\frac{Q}{L} = \frac{a\, A^b\, L^c}{L} = a\, A^b\, L^{c-1} \tag{24}$$

For a given value of A, this would decrease as L increases if(c-1) is negative, i.e., if c is less than +1. Similar arguments would hold for the average product of area. The marginal product of labour is:

$$\frac{dQ}{dL} = c.a\, A^{b}L^{c-1} = c\left(\frac{Q}{L}\right) \qquad (25)$$

Thus they both change at a fixed proportion c (usually positive), and it follows that marginal product would be decreasing whenever c is less than unity.

This means that if the law of diminishing returns applies, both b and c would be less than unity. If c is less than unity, then with the adoption of intensive agriculture, production increases at a decreasing rate which is smaller than the rate of increase of labour. However, similar conclusions might be ambiguous when considering b. The increase in area, keeping labour constant, implies the adoption of less intensive agriculture. There is no reason to expect the relative changes in production should be smaller or greater than the relative changes in area unless something is assumed about the nature of the additional area. It is possible however to discuss another, probably more meaningful, possibility. Let us assume that an increase takes place in area and at the same time the proportionality between the factors is preserved. It can be generally expected that at the same level of intensity, any horizontal expansion would mean the addition of less fertile lands. Therefore we expect that production would increase, but at a smaller rate than the rate of increase of area. Suppose that we decide to use an area which is m times the original area A. Then we should increase labour also to m times its original level, L. The new production would be:

$$a(mA)^{b}(mL)^{c} = m^{b+c}(a\, A^{b}L^{c}) = m^{b+c}Q$$

In other words, the relative change in production would be less than, equal to, or greater than the relative change in both area and labour (which is m) according to whether the value of (b+c) is less than, equal to, or greater than unity. It is generally believed that agricultural production satisfies the first of these conditions.

Since both b and c are positive, and c has been found smaller than unity, then b should be also smaller than unity.

The above-mentioned formulae are not quite realistic since they neglect the important factor, capital, both fixed and liquid. If it is assumed that variations in fixed capital were not appreciable, so that we can safely ignore it ,the same connot be easily applied to working capital, which can be denoted by K . Suppose now that we introduce it in the equation with a coefficient d. Then (23) becomes:

$$Q = a\,A^{b}L^{c}K^{d}$$

Lacking information on this variable let us introduce some simplifying assumption. We can for example assume that the behaviour of farmers was such that they held a constant relation between area and working capital: $K = gA$ say. Then equation (23) becomes:

$$Q = a'A^{b'}L^{c}$$

where

$$a' = a.g^{d}\,, \qquad b' = b+d$$

The previous arguments can be easily extended to this formula. But it can be argued that this assumption does not fit in with cases in which there had been radical changes in intensity of cultivation. It might be more reasonable to assume that this assumed relationship ties K to L rather than to A. This wouldbe more realistic if L reflects truly the amount of labour input actually used. A more reasonable assumption still is that this assumed proportionality stands between K and Q itself, $K = s.Q$. Then substituting in (23)

$$Q = a.A^{b}L^{c}(sQ)^{d} = (a.s^{d})^{1/(1-d)}.A^{b/(1-d)}\,L^{c/(1-d)} \qquad (26)$$

This new equation is very similar to (23). It can be noticed that testing the equality of the sum of the two exponents to unity is equivalent to testing that the sum of the original three is equal to unity. For

$$\text{if} \quad \frac{(b+c)}{1-d} = 1, \quad \text{then} \quad b + c = 1 - d$$

hence,

$$b + c + d = 1$$

where d itself is positive and less than unity.

There remains another factor which has been mentioned in our early analysis . To take account of the assumed increasing redundancy of labour, and of the improvements in the methods of production, the use of more capital, etc., we have to introduce time t as a variable in the function. Thus a trend term appears and its coefficient expresses the sumtotal of the effects of the various factors which it stands for. A part of its effect is assumed to be negative to account for the required corrections in the labour series. The remaining part is assumed to be positive owing to the expected rise in production resulting from the various improvements. If we introduce an additive trend to the equation in its logarithmic form (22) , besides the introduction of W for water passing through the Asswan Dam, and F for fertilizers (supplied in the preceding calender year), our equation becomes:

$$\log Q = a' + b \log A + c \log L + d \log W + f \text{ lof } F + g.t$$

Further, it has been argued that such a function would best fit the allocation-free index of production : $Y = Q/X$. Hence we should replace the left-hand side by $\log Y = \log Q - \log X$, and the equation becomes:

$$\log Q = \log X + a' + b \log A + c \log L + d \log W + f \log F + g.t \tag{27}$$

or,

$$Q = a.X.A^b L^c W^d F^f e^{gt} \tag{28}$$

where e is the base of the natural logarithms.

5. Statistical Estimation of the Function:

Let us now obtain estimates of the coefficients a,b,c,.... We have first to add a random component, u to equation (27), which stands to inaccuracies in the equation or errors in measurement of variables or both . This term would cover variables neglected from the equation (such as capital) or accidental variations (weather, insects, ...). It would also reflect deviations in the behaviour of producers from the assumed norm owing to unexplained factors. In fact a complete specification of u gives us the only means of obtaining the real estimates of the coefficients. Wanting such a specification, we assume that it is randomly distributed with a zero mean and a constant variance (over time). We shall also assume that it is independent of the explanatory variables, which might be diffi cult to defend if there are appreciable errors in their measurement. However, the method of statistical investigation would be much easier if we adopt this latter assumption, since the proper methods to be adopted in its absence raise many complications, and require more information than we could obtain. The bias arising in the stimates would be negligible provided the equation is realistic. Therefore, we shall be satisfied with the application of the familiar least-squares method to our data.

Let us first try to fit equation (22) which was found deficient on theoretical grounds. We obtain for the period 1913-1955 (Table VIII) the following estimates (using common logarithus)

$$\log Q = -0.9700 + 1.011 \log A + 0.306 \log L \qquad (29)$$

The multiple correlation coefficient is 0.636 which is greater than the 1% significance level, 0.454 . Thus it differs significantly from zero, and we can accept the existence of an equation of the assumed form. The standard error of the area coefficient is 0.496 which means that it differs from zero at the 5% level, and that it might be smaller than unity. The standard error of the labour coefficient is 0.088, and it is also significantly different from zero. Finally the standard error of the sum b+c = 1.317 is 0.434 which does not exclude the possibility that this sum is actually smaller than unity.

Fitting equation (27) except for fertilizers, we obtain:

$$\text{Log } Y = 0.3483 + 0.485 \log A + 0.356 \log L + 0.000413\, t + 0.043 \log W + u \qquad (30)$$

The multiplecorrelation coefficient is 0.829 which is significantly different from zero. The standard errors of the coefficients are: 0.329, 0.126 , 0.000781 and 0.059 which are large compared with the coefficients. However, the absolute values of the coefficients seem to be more reasonable than those given by (29) ,especially for area.

This is due to the introduction of the allocation factor, X. In fact this can be illustrated by consideration of the function in A and L:

$$\text{Log } Q = 0.2922 + \log X + \underset{(0.324)}{0.484} \log A + \underset{(0.071)}{0.418} \log L + u \qquad (31)$$

The multiple correlation coefficient is now 0.825, and if we had calculated it with respect to Q it would have been much higher since X accounts for about one third of the variation in Q. However the coefficient of log A has a high standard error.

If we now introduce F over and above , our equation would become:

$$\log Q = 1.3066 + \log X + \underset{(0.337)}{0.200} \log A + \underset{(0.123)}{0.297} \log L + \underset{(0.0140)}{0.0316} \log F + \underset{(0.000756)}{0.000089}\, t + \underset{(0.0565)}{0.0367} \log W + u \qquad (32)$$

The correlation coefficient is somewhat increased to 0.851 but the coefficient of t and log W are highly insignificant . It seems that we can dispense with them, and the equation can be written as:

$$\log Q = 1.3814 + \log X + \underset{((0.329)}{0.196} \log A + \underset{(0.080)}{0.313} \log L + \underset{(0.0135)}{0.0324} \log F + u \qquad (33)$$

The correlation coefficient is hardly affected being 0.849. However, the area coefficient is still insigificant, and as it stands, both labour and fertlizers seem to be the dominating factors. This does not sound unrealistic in a period characterized by more intensive rather than extensive cultivation. However, the large variations occuring in fertlizers have tended to decrease the absolute value of its coefficient , a defect which would have been partly amended if manures could have been included. The quite significant labour coefficient seems to be due to the highly correlated trends in the labour and productivity series. However, the coefficients do not seem to be very from what could have been expected on theoretical grounds. Any improvement should await collection of more information on other factors here excluded. IT is hoped that some interested reader would take of the shortcomings of this study, whether those mentioned or not.

Statistical Appendix

Contents of Tables:

Table I - Basic Series

Column 1- Cultivable area, thousand Feddans.
2- Cultivated area ,, ,,
3- Exploitation area thousand Feddan / years.
4- Rate of exploitation (X 1000).
5- Index number of population (base = 1000)
6- Index of cultivated area (base = 1000)
7- Per capita share of cultivated area (1/1000 Feddans).
8- Index number of exploitation area (base = 1000)
9- Index number of the ratio of agricultural labour force to total population (base = 1000). Ratio in base period = 17.9% .
10- Index number of the ratio of rural to total population (base = 1000)

Table II - Crop Areas in 1000 Feddans

Table III - Averag. product per 100 Feddan

Table IV - Total crop

Table V - Prices (milliems perunit)

Table V1 - Total value of crops (L.E.000)

The columns in these 5 tables are : (units indicated)

1- Cotton: (Cantar)
2- Cotton - seed (Ardeb)
3- Rice (dariba)
4- Wheat (ardeb)
5- Maize (;;)
6- Millet (,,)

7- Barley (ardeb)
8- Sugar - Cane (100 cantars)
9- Beans (ardeb)
10-Onion (100 cantars)
11-Lentiles (ardeb)
12-Helba (ardeb)

Table V11 - Index numbers of average productivities.

Table V111 - Index numbers used in estimation

(base : 1950 - 154 = 1000)

M = Money value of production
P = Prices
Q = Quantity of production
V = Average productivity
B = Weighted index of area
A = Simple index of area
X = Index of allocation.
Y = Allocation-free Production
L = Labour
W = Water
F_{-1}=Preceding year's Fertilizers.

Tale (I) - Basic Series.

year	1	2	3	4	5	6	7	8	9	10
1913	7947	5283	3566	675	573	932	433	1591	1046	855
1914	7968	5023	3514	700	580	886	407	1549	1041	855
1915	7980	5309	3564	671	587	936	425	1551	1043	855
1916	8006	5232	3603	684	594	923	414	1549	1046	855
1917	8040	5319	3522	662	601	938	416	1497	1050	855
1918	8067	5282	3422	649	608	931	408	1439	1065	853
1919	8128	5297	3475	656	614	934	405	1445	1082	850
1920	8134	5305	3595	678	621	935	401	1479	1098	847
1921	8129	5352	3597	672	628	944	400	1463	1137	844
1922	8048	5341	3805	712	635	942	395	1531	1180	842
1923	8047	5387	3750	696	642	950	394	1493	1211	839
1924	8094	5192	3739	720	649	916	376	1472	1246	836
1925	8170	5420	3843	709	656	956	388	1496	1274	828
1926	8170	5385	3902	725	663	950	381	1503	1307	828
1927	8277	5544	3945	712	671	978	388	1503	1327	825
1928	8246	5554	3965	714	678	979	385	1493	1350	821
1929	8192	5616	4118	733	686	990	385	1534	1366	818
1930	8239	5549	4066	733	694	978	376	1497	1377	815
1931	8241	5485	3886	708	702	967	367	1415	1384	810
1932	8216	5464	3826	700	710	963	362	1378	1393	804
1933	8309	5384	3775	701	718	949	352	1344	1403	801
1934	8467	5277	3687	699	726	931	342	1298	1391	788
1935	8307	5229	3699	707	734	922	335	1287	1374	774
1936	8316	5361	3703	691	742	945	339	1275	1370	768
1937	8322	5316	3761	707	752	937	332	1278	1359	759
1938	8325	5312	3764	709	766	937	326	1256	1338	759
1939	8336	5338	3748	702	779	941	322	1229	1343	761
1940	8348	5351	3794	709	793	944	317	1222	1325	761
1941	8353	5186	3734	720	808	914	302	1181	1296	760
1942	8301	5309	3677	693	822	936	304	1143	1271	751
1943	8302	5331	3841	720	837	940	299	1172	1254	750
1944	8306	5698	3725	654	852	1005	314	1117	1234	749
1945	8337	5730	3793	662	867	1010	310	1117	1208	744
1946	8146	5770	3692	640	883	1017	307	1068	1185	742
1947	8142	5761	3800	660	896	1016	302	1084	1162	739
1948	8343	5753	3830	666	915	1015	295	1069	1123	736
1949	8306	5834	3837	658	935	1029	293	1049	1090	734
1950	8309	5834	3878	665	955	1029	287	1037	1060	731
1951	8312	5613	3938	702	981	990	269	1026	1028	728
1952	8312	5598	3858	689	999	987	263	987	999	725
1953	8309	5642	3820	677	1021	995	260	956	971	723
1954	8392	5670	4074	718	1044	1000	255	997	947	720
1955		5697	4054	712	1068	1005	251	970	926	717

See notes to table (I)

Table (II) Crop Areas (000 feddans)

Year	I,2	3	4	5	6	7	8	9	I0	II	I2
I913	I723	225	I306	I686	204	369	48	478	28	60	50
I914	I755	43	I253	I820	285	383	48	428	I6	35	37
I915	II86	320	I534	I777	275	446	52	623	23	63	48
I916	I656	I48	I394	I675	245	423	59	503	30	62	57
I917	I677	263	I076	I623	264	479	62	472	28	92	92
I918	I316	37I	I239	I745	303	324	64	476	44	68	I03
I919	I574	I44	I275	I727	257	343	57	505	29	62	92
I920	I828	I59	II47	I867	249	328	52	4I8	33	70	90
I921	I290	3I2	I405	2009	259	380	64	494	27	78	79
I922	I80I	48	I462	I960	237	36I	63	476	35	85	75
I923	I7I5	I79	I48I	I797	224	386	56	47I	40	80	76
I924	I788	246	I364	I809	230	359	5I	436	39	73	84
I925	I924	I37	I329	2000	2I3	353	5I	446	39	64	I03
I926	I786	229	I475	2086	273	32I	52	4I4	36	63	74
I927	I5I6	420	I594	2I33	255	362	47	447	4I	8I	74
I928	I738	255	I532	2059	232	353	57	5II	52	84	64
I929	I841	3I6	I555	2086	255	386	54	502	58	69	70
I930	2082	346	I466	I827	260	332	54	424	4I	74	75
I93I	I683	65	I589	2II3	330	295	65	424	43	82	I05
I932	I094	472	I697	I968	346	352	70	592	45	9I	I22
I933	I804	422	I374	I578	263	282	7I	469	64	85	88
I934	I732	392	I389	I572	295	274	60	432	4I	88	87
I935	I669	47I	I4I0	I575	335	27I	60	4I6	35	8I	8I
I936	I7I6	47I	I4I0	I520	333	272	6I	395	33	78	94
I937	I978	263	I369	I559	320	26I	68	386	42	76	92
I938	I784	476	I4I6	I497	390	264	68	385	26	79	86
I939	I625	545	I446	I549	4I2	263	72	385	35	8I	83
I940	I685	509	I506	I540	374	268	76	394	30	82	80
I94I	I644	448	I502	I527	429	256	78	369	33	82	79
I942	706	673	I576	I983	824	32I	88	359	I7	76	II0
I943	7I3	642	I9I7	I95I	729	4I9	87	38I	I9	57	57
I944	853	620	I65I	I890	728	33I	96	425	2I	8I	52
I945	982	630	I647	I879	684	359	96	392	22	75	55
I946	I2I2	632	I586	I653	55I	245	92	38I	24	78	65
I947	I254	776	I630	I608	543	237	94	382	33	73	6I
I948	I44I	786	I5I6	I55I	525	220	9I	398	33	73	64
I949	I692	703	I4I7	I494	499	I68	85	424	40	7I	55
I950	I975	700	I372	I45I	393	II7	8I	356	36	8I	53
I95I	I979	488	I497	I655	423	II8	86	320	37	75	53
I952	I967	374	I4I2	I704	433	I37	92	355	32	58	54
I953	I324	423	I790	20I5	486	II6	I04	299	35	69	53
I954	I579	6I0	I795	I904	457	I22	II5	3I0	45	87	5I
I955	I8I6	600	I523	I833	437	I36	III	358	50	8I	6I
1956	1653	690	1570	1836	478	132	110	337	46	82	61
1957	1818	731	1514	1769	449	133	109	355	50	83	65

See notes to table (II)

Table (III) Average product (per I00 feddans)

Year	I	2	3	4	5	6	7	8	9	I0	II	I2
I9I3	444	304	I62	525	633	746	586	655	553	I90	470	380
I9I4	367	260	II3	475	7I6	807	524	675	44I	I44	388	380
I9I5	402	306	I37	463	74I	826	560	668	447	I57	352	380
I9I6	306	233	I23	475	696	8II	565	675	400	I57	396	39I
I9I7	375	287	I46	503	7I5	733	572	655	453	I4I	362	369
I9I8	366	28I	I47	47I	68I	840	568	635	473	I57	398	380
I9I9	354	27I	I34	429	672	843	533	675	448	I50	39I	37I
I92I	330	253	I4I	502	686	842	578	689	446	I5I	359	365
I92I	337	259	I20	478	607	807	57I	652	446	I46	399	335
I922	373	286	9I	455	6I5	797	568	654	444	I4I	358	330
I923	38I	292	I34	498	678	805	564	684	443	I4I	304	303
I924	407	309	I32	455	678	823	544	742	395	I48	406	334
I925	4I4	3I6	I36	494	700	845	572	693	445	I48	402	335
I926	429	327	I38	457	70I	879	57I	704	387	I4I	375	3I6
I927	40I	305	I36	505	696	833	600	692	465	I5I	4I2	347
I928	464	35I	I42	442	692	902	555	747	380	I48	278	309
I929	463	35I	I4I	528	70I	9I7	595	864	456	I60	374	332
I930	397	300	I39	492	694	858	574	644	43I	I43	380	32I
I93I	378	285	II8	526	67I	895	597	725	4I7	I49	376	325
I932	453	342	I25	560	70I	885	62I	7I8	487	I49	393	325
I933	475	358	I35	528	668	823	595	724	447	I48	382	320
I934	436	329	I40	487	7I4	92I	598	787	409	I44	349	3I0
I935	5II	380	I60	556	766	987	70I	77I	455	I4I	4I2	33I
I936	53I	399	I57	588	749	875	722	773	489	I47	42I	360
I937	557	370	I5I	60I	756	908	735	782	494	I56	449	363
I938	467	3I6	I63	588	749	862	735	75I	478	I63	404	37I
I939	535	360	I74	6I5	703	926	755	759	5I3	I7I	484	384
I940	544	365	I39	602	709	867	750	733	509	I66	480	384
I94I	509	340	I35	499	600	78I	686	678	498	I69	472	490
I942	600	399	I48	534	523	836	7I7	633	498	I39	460	378
I943	500	343	II3	449	404	758	625	557	48I	I35	468	358
I944	544	373	I39	382	589	749	57I	604	490	I25	397	368
I945	43I	36I	I45	479	645	766	608	6II	507	I62	440	394
I946	500	306	I57	489	6I5	68I	605	6II	508	I4I	400	383
I947	508	336	I74	427	623	76I	596	644	442	I39	39I	374
I948	6I7	402	I76	475	649	760	630	609	466	I43	420	38I
I949	5I4	339	I76	549	598	8I3	684	588	488	I54	4I6	398
I950	430	295	I88	495	643	773	649	69I	359	I2I	393	342
I95I	408	282	I35	539	6I3	873	702	727	468	I42	339	383
I952	504	353	I46	5I8	63I	862	7I9	785	453	I34	345	402
I953	535	38I	I63	576	657	855	740	790	45I	I32	427	399
I954	490	348	I94	642	658	858	789	8I7	490	I38	433	4I5
I955	4I0	294	23I	635	667	878	778	83I	473	I29	380	4I6
I956	438	3I9	24I	657	643	886	8I3	828	394	I29	363	422
I957	475	347	247	646	604	90I	8I8	842	46I	I32	399	428

See notes to table (111)

Table (IV) Total Crop

1	2	3	4	5	6	7	8	9	10	11	12	Year
7664	5232	367	6583	10682	1519	2162	31747	2644	5343	282	188	1913
6451	4566	49	5960	13027	2300	2010	32541	1889	2337	137	141	1914
4775	3629	439	7102	13163	2269	2494	34857	2784	3663	224	184	1915
5060	3865	184	6630	11655	1985	2388	39976	2010	4655	247	224	1916
6293	4814	389	5413	11604	2204	2739	40760	4138	3984	332	341	1917
4821	3693	552	5831	11881	2542	1841	40370	2250	6832	272	392	1918
5572	4269	194	5468	11608	2165	1830	38569	2262	4390	244	340	1919
6036	4620	225	5753	12804	2095	1896	35495	1868	4920	251	328	1920
4353	3339	377	6715	12186	2094	2167	41723	2199	4008	313	265	1921
6713	5148	43	6649	12058	1886	2051	40946	2119	4907	306	247	1922
6531	5005	239	7376	12175	1804	2175	38279	2086	5709	277	231	1923
7274	5532	324	6203	12260	1894	1951	38214	1723	5825	297	282	1924
7965	6077	186	6562	14003	1811	2022	35590	1983	5785	259	345	1925
7652	5832	316	6751	14621	2393	1832	36652	1604	5146	238	233	1926
6087	4493	572	8046	14862	2123	2170	32727	2080	6197	334	258	1927
8068	5599	361	6767	14250	2094	1959	42397	1944	7636	234	198	1928
8531	5920	445	8206	14621	2337	2299	35824	2291	9350	256	232	1929
8276	5813	482	7213	12680	2235	1906	34489	1826	5856	281	242	1930
6357	4449	77	8359	14189	2950	1759	47353	1765	6469	308	343	1931
4956	3509	589	9511	13799	3065	2189	50296	2884	6699	357	395	1932
8575	5760	571	7249	10541	2167	1676	51248	2096	9530	324	280	1933
7556	5214	549	6763	11227	2718	1639	47406	1766	5917	305	268	1934
8535	5437	756	7842	12064	3308	1898	46506	1889	4885	334	269	1935
9107	6056	741	8292	11395	2911	1964	47355	1930	4852	327	339	1936
11009	7325	398	8233	11794	2903	1918	53035	1910	6593	343	333	1937
8340	5641	776	8334	11219	3357	1939	51220	1839	4254	321	320	1938
8692	5847	950	8892	10888	3818	1985	54898	1974	5992	392	320	1939
9170	6151	706	9071	10925	3241	2009	55952	2005	4889	394	308	1940
8374	5593	606	7492	9158	3352	1754	52650	1836	5490	390	324	1941
4233	2819	994	8411	10369	6887	2306	55638	1789	2310	351	417	1942
3569	2442	725	8611	9836	5524	2620	48656	1832	2572	268	205	1943
4640	3181	862	6307	11135	5454	1890	57717	2080	2585	322	191	1944
5221	3551	917	7880	12124	5241	2180	58855	1988	3527	330	215	1945
6066	4145	993	7752	10157	3752	1480	56323	1935	3327	311	248	1946
6370	4208	1351	6962	10010	4127	1414	60302	1686	4605	285	227	1947
8900	5803	1384	7203	10066	3989	1387	55592	1852	4699	307	247	1948
8705	5744	1236	7782	8928	4052	1152	50280	2069	6213	294	218	1949
8500	5825	1314	6785	9329	3040	757	56290	1276	4430	320	182	1950
8076	5576	656	8060	10151	3694	830	62534	1495	5226	293	203	1951
9922	6939	547	7260	10757	3732	981	72561	1610	4317	199	217	1952
7082	5041	690	10311	13237	4155	860	82120	1348	4615	295	210	1953
7746	5491	1183	11529	12520	3923	963	93825	1534	6196	376	213	1954
7437	5344	1386	9676	12241	3836	1055	92116	1693	6478	307	252	1955
7230	5270	1665	10316	11803	4241	1074	90927	1328	5950	298	256	1956
8635	6308	1808	9781	10680	4044	1088	91924	1637	6590	331	277	1957

See notes Table (1V) %

Table (V) Prices, (milliems per unit)

1	2	3	4	5	6	7	8	9	10	11	12	Year
3803	895	8750	1406	1093	1006	958	32	1343	105	1428	1148	1913
2402	673	8146	1381	925	828	789	33	1334	316	1577	1389	1914
3857	1056	8706	1526	1051	1017	1036	35	1156	200	1791	1763	1915
7562	1184	13676	1880	1603	1435	1110	40	1822	168	1871	2417	1916
7703	891	15251	3081	1956	1974	1415	49	2224	307	2068	3728	1917
7440	973	15663	3107	2195	2064	1710	55	2450	165	2520	3008	1918
17562	2157	28306	3649	3040	3553	2505	65	4036	391	3814	3280	1919
6900	1252	16293	3275	1294	1216	2072	102	4093	326	3554	3348	1920
6858	1235	14228	1989	1110	1120	951	92	1569	434	1811	1818	1921
6142	1088	15243	1684	1162	1227	1135	60	2043	293	1565	1944	1922
7959	1236	11585	1469	1245	1216	941	48	2138	142	1514	2947	1923
7897	1365	13011	1961	1688	1787	1221	50	2423	204	2102	3914	1924
6093	984	13571	2158	1282	1361	1182	43	2305	244	2540	2089	1925
4306	873	10771	1703	878	902	1009	38	2638	243	2141	1505	1926
5936	1130	9861	1385	1113	1177	880	39	1872	208	1701	1402	1927
5176	975	10246	1620	1279	1220	940	38	1590	166	2108	2020	1928
4072	818	9511	1420	950	751	720	37	1510	109	1851	2030	1929
2410	540	8313	1291	950	890	700	41	1830	206	1721	1740	1930
2016	612	9730	1320	775	740	880	38	1590	234	1429	1227	1931
2456	690	6020	1070	590	550	560	35	850	162	900	800	1932
2278	393	6248	1120	1043	939	465	34	878	46	1022	996	1933
2650	596	7403	1499	1060	908	901	34	1550	173	1755	2480	1934
2726	643	6668	1427	734	629	847	34	1527	151	1704	2234	1935
2870	768	7070	1149	838	820	505	34	1277	193	1469	1280	1936
2154	532	8129	1265	1073	972	738	34	1332	90	1529	1150	1937
2136	604	6799	1445	1051	779	703	34	1497	231	1555	1217	1938
2896	509	6991	1355	942	782	682	36	1262	139	1414	1414	1939
2818	640	8409	1364	1253	972	763	44	1154	146	1776	2009	1940
3320	641	10518	1781	1210	1035	1300	45	2476	120	2463	2706	1941
4094	1022	15181	2900	2330	2330	2200	71	3290	180	2790	2770	1942
5184	1010	17351	2900	2330	2330	2250	91	4020	390	4450	3600	1943
6116	1010	19085	3980	2630	2630	2250	91	4020	660	4450	6171	1944
6526	1010	19085	3980	2630	2630	2490	91	4020	380	4450	5670	1945
7470	1007	19295	3594	2350	2350	1850	95	4050	690	4450	4780	1946
12052	1007	20065	3287	2350	2050	1600	95	4380	380	4450	4400	1947
11174	1016	20065	3300	2350	2050	1600	95	4450	550	4450	4765	1948
15000	1016	20065	3300	2300	2100	1220	95	3510	960	4600	4130	1949
25110	1016	18485	3300	2450	2450	2620	115	5840	1030	6110	6200	1950
18650	800	18485	3300	2450	2200	3070	115	6230	755	6240	7440	1951
12420	800	14500	3300	2700	2360	2060	115	5760	754	9080	4560	1952
12097	800	15250	4900	2700	2430	2750	115	5370	766	9150	5690	1953
12338	800	15750	4400	2641	2648	1949	110	4847	324	9150	6433	1954
11957	800	16500	3900	3862	3628	2869	105	5659	355	6294	8292	1955

See notes to Table (V).

Table (VI) Total value of crops (L.E.000)

1	2	3	4	5	6	7	8	9	10	11	12
29145	4682	3211	9256	11675	1528	2071	1016	3551	561	403	216
15494	3073	399	8231	12050	1904	1586	1074	2520	738	216	196
18416	3833	3822	10838	13834	2308	2584	1220	3218	733	401	324
38267	4576	2516	12464	18683	2848	2651	1599	3662	782	462	541
48478	4287	5933	16677	22697	4351	3876	1997	9203	1223	687	1271
35866	3593	8646	18117	26079	5247	3148	2220	5513	1129	685	1179
97849	9208	5491	19953	35288	7692	4584	2507	9129	1716	931	1115
41645	5784	3666	18841	16568	2548	3929	3620	7646	1604	892	1098
29853	4124	5364	13356	13526	2345	2061	3839	3450	1739	567	482
41233	5600	655	11197	14011	2314	2328	2457	4320	1438	479	480
51984	6186	2769	10835	15158	2194	2047	1837	4460	811	419	681
57443	7553	4216	12164	20695	3385	2382	1911	4175	1188	624	1104
48529	5979	2524	14161	17952	2465	2390	1530	4571	1412	658	721
32950	5091	3404	11497	12837	2158	1848	1393	4231	1250	510	351
36134	5223	5640	11144	16541	2499	1910	1276	3894	1289	568	362
41760	5958	3699	10963	18226	2535	1841	1611	3091	1268	493	400
34739	5286	4232	11653	13890	1755	1655	1325	3459	1019	474	471
19945	3378	4007	9312	12046	1989	1334	1414	3342	588	484	421
12816	2937	749	11034	10996	2183	1548	1799	2806	1514	440	421
12172	3584	3546	10177	8141	1686	1226	1760	2451	1085	321	316
19534	2538	3568	8119	10994	2035	779	1742	1840	438	331	279
20022	3391	4064	10138	11901	2468	1477	1612	2737	1024	535	665
23266	4083	5041	11191	8855	2081	1608	1581	2885	738	569	601
26138	5255	5239	9528	9549	2387	992	1610	2460	936	480	434
23713	3897	3235	10415	12655	2822	1415	1803	2544	593	524	383
17813	3407	5276	12043	11791	2615	1363	1741	2753	983	499	389
25172	3503	6641	12049	10256	2986	1354	1976	2491	833	554	452
25840	3936	5937	12373	13689	3150	1533	2462	2314	715	700	619
27802	3585	6374	13343	11081	3469	2280	2369	4546	659	961	877
17329	2881	15090	24392	24160	16047	5073	3950	5886	416	979	1155
18504	2466	12579	24972	22918	12871	5895	4428	7365	1003	1193	738
28380	3213	16451	25102	29285	14344	4253	5252	8362	1706	1433	1179
34072	3590	17501	31362	31886	13784	5428	5356	7992	1340	1469	1434
45290	4174	19160	27512	23869	8817	2738	5351	7837	2296	1384	1185
76769	4238	27108	22884	23524	8460	2262	5729	7385	1750	1268	999
99446	5896	27770	23770	23655	8177	2219	5281	8241	2584	1366	1177
130566	5836	24800	25681	20534	8509	1405	4777	7262	5964	1352	900
[illegible]13436	5919	24289	22391	22856	7448	1983	6473	7452	4563	1955	1128
150617	4460	11941	26598	24870	8127	2548	7191	9314	3946	1828	1510
123231	5551	7932	23958	29044	8808	2021	8345	9274	3255	1807	990
85671	4033	10523	50524	35740	10097	2365	9444	7239	3555	2699	1195
97119	4393	18632	50728	33065	10388	1877	10321	7435	2008	3440	1370
88924	4275	22869	37736	47275	13917	3027	9672	9581	2300	1932	2090

See notes to Table (VI)

Table (VII) Index numbers of the average productivites for various crops

crop	Period									Actual Average in base period
	1913 -19	1920 -24	1925 -29	1930 -34	1935 -39	1940 -45	1946 -49	1950 -54	1955 -57	
Cotton	79	77	92	91	101	114	113	100	93	4.73 cantars
Rice	83	87	84	79	98	83	104	100	145	1.65 dariba
Wheat	86	86	88	94	107	89	88	100	117	5.53 ardebs
Maize	108	102	109	108	116	93	97	100	100	6.40 ardebs
Millet	95	97	104	104	108	94	89	100	105	8.44 ardebs
Barley	78	78	80	83	101	92	87	100	112	7.44 ardebs
Sugar-cane	87	90	92	94	101	83	80	100	109	762 cantars
Beans	103	98	96	99	109	112	107	100	100	4.44 ardebs
Onions	118	108	113	111	117	112	108	100	98	133 cantars
Lentiles	99	92	93	95	109	118	103	100	96	3.97 ardebs
Helba	97	86	84	82	93	102	99	100	108	3.89 ardebs
Overall average	88	84	94	94	109	100	104	100	102	-

Table (VIII) Index numbers used in estimating the function

Year	M	P	Q	V	B	A	X	Y	L	W	F_{-1}
1913	276	308	867	957	906	911	995	872	580	873	79
1914	188	248	759	861	881	898	981	773	585	519	92
1915	244	326	747	917	815	911	895	834	593	1077	96
1916	353	507	696	777	896	921	973	716	602	790	78
1917	479	581	823	918	897	900	997	826	612	1466	33
1918	442	607	727	871	835	874	955	761	627	1448	47
1919	775	1087	713	825	864	888	973	733	644	873	4
1920	428	566	755	823	917	919	998	756	661	945	72
1921	320	479	669	804	832	919	905	739	692	992	154
1922	343	436	787	827	952	972	980	804	726	911	56
1923	394	484	815	869	938	958	979	843	753	1099	150
1924	463	544	852	894	953	955	998	854	784	1100	133
1925	408	452	903	920	982	982	1000	904	810	1083	233
1926	307	343	896	922	972	997	975	919	840	866	336
1927	343	400	856	911	940	1008	932	919	862	1065	310
1928	364	388	940	958	981	1013	968	971	888	900	290
1929	317	312	1014	989	1028	1052	977	1040	908	1028	351
1930	231	247	934	898	1040	1039	1001	933	926	1300	421
1931	195	233	838	890	942	993	949	883	942	883	406
1932	180	213	847	982	862	978	882	960	958	997	337
1933	207	217	952	987	965	964	1000	952	975	1118	302
1934	238	267	892	949	940	942	998	894	978	1031	384
1935	248	247	1004	1071	939	945	993	1012	978	1176	546
1936	258	249	1036	1103	940	945	993	1043	986	1214	723
1937	254	230	1102	1136	970	961	1009	1092	990	1083	749
1938	241	242	993	1037	958	962	997	997	1007	1028	840
1939	271	257	1054	1117	943	958	985	1070	1014	1307	685
1940	291	277	1047	1069	956	969	986	1062	1019	917	628
1941	307	325	943	998	945	954	991	952	1014	814	472
1942	465	554	840	1031	816	940	968	968	1013	835	27
1943	456	614	742	897	827	981	843	881	1017	1036	200
1944	551	701	786	947	830	952	872	901	1019	1019	218
1945	615	709	868	1002	866	969	894	971	1016	899	369
1946	593	693	856	979	875	943	928	923	1014	1017	358
1947	723	821	881	991	889	971	916	962	1009	1347	291
1948	831	791	1051	1128	932	979	952	1104	1002	1027	612
1949	942	916	1029	1044	985	980	1005	1024	999	1084	708
1950	1269	1226	982	931	1055	991	1065	923	999	1059	909
1951	1003	1059	947	904	1047	1006	1041	910	1001	1086	962
1952	889	844	1054	1026	1027	986	1042	1011	998	910	1017
1953	885	911	971	1080	899	976	921	1054	999	911	1067
1954	955	891	1072	1061	1010	1041	970	1104	1003	1035	904
1955	966	832	1036	994	1043	1036	1007	1029	1010	1342	1050
1956	.	.	1040	1035	1005	1035	971	1071	.	.	1046
1957	.	.	1104	1043	1058	1053	1005	1099	.	.	.

Table (1X)- Centralized 4 - years moving averages

Year	Q	Y	X	V	Q/N	L/A	Y/L
1913						687	
1914						651	
1915	762	793	961	886	1298	661	1337
1916	752	786	957	869	1266	654	1306
1917	744	772	964	862	1238	680	1261
1918	747	764	978	843	1229	717	1219
1919	735	758	970	848	1197	725	1177
1920	723	753	960	830	1164	719	1139
1921	744	772	964	830	1185	723	1116
1922	769	798	964	843	1211	747	1099
1923	809	831	974	863	1260	786	1104
1924	848	866	979	886	1307	821	1105
1925	867	889	975	903	1322	825	1098
1926	888	914	972	821	1339	843	1088
1927	913	945	966	940	1361	855	1096
1928	932	964	967	936	1375	877	1086
1929	934	961	972	939	1362	863	1058
1930	920	955	963	943	1326	891	1031
1931	901	943	955	949	1283	949	1001
1932	887	927	957	941	1249	980	968
1933	903	938	963	976	1258	1011	962
1934	942	965	976	1018	1298	1038	987
1935	990	993	997	1049	1349	1035	1015
1936	1021	1023	998	1059	1376	1042	1038
1937	1040	1043	997	1093	1383	1030	1054
1938	1048	1053	995	1098	1368	1047	1046
1939	1029	1038	991	1077	1321	1058	1024
1940	990	1017	973	1066	1248	1052	998
1941	932	989	942	1028	1153	1063	975
1942	860	946	909	994	1046	1078	934
1943	818	928	881	975	977	1037	912
1944	811	925	877	971	952	1070	908
1945	330	929	893	963	957	1049	914
1946	881	965	913	1009	998	1075	952
1947	934	997	937	1029	1042	1039	988
1948	970	1003	967	1015	1060	1023	1001
1949	994	997	997	999	1037	1019	998
1950	1003	979	1025	1007	1050	1008	980
1951	996	971	1026	997	1015	995	970
1952	1000	997	1003	1000	1001	1012	999
1953	1022	1035	987	1013	1001	1024	1036
1954	1031	1057	975	1039	988	963	1057
1955	1046	1070	978	1043	979	975	1059