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MARGINAL PRODUCTIVITY WAGE THEORY AND SUBSISTENCE WAGE THEORY IN EGYPTIAN AGRICULTURE

by

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in

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Marginal Productivity Wage Theory and Subsistence Wage Theory in Egyptian Agriculture.*)

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1. Agricultural Wages in Modern Growth Theory.

In modern growth models various theories of wage determination have been applied. On the one hand, in particular in models inspired by Solow,[1] one meets the traditional marginal productivity theory according to which the money wage rate is equal to, or at least, governed by the value of the marginal product of labour. Sometimes a different formulation is used: that real wages equal the marginal productivity of labour.[2] If in the general model in connection with which the latter formulation is used only one commodity is produced and consumed, or a uniform price for all commodities is assumed, or prices are disregarded altogether, then the two formulations coincide. But if output prices and wage good prices differ we have to use the first formulation. For the following discussion it is important to keep this in mind.

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*) In the statistical work I was assisted by Fathia Zaghloul who compiled the price information necessary for the calculation of the cost-of-living index for agricultural labourers, computed the index, and made the calculations behind the regression equations, and Mona El Tomy who helped me with some of the other statistical series. I thank both of them for their valuable help.
I acknowledge gratefully the permission to use some of the statistical material collected for the "Survey of Rural Employment" of the Institute of National Planning, jointly undertaken with the ILO, Geneva. In particular I thank Dr. Ulrich Planck, ILO-expert at the INP, for his helpfulness in making the material available to me.

1) R. Solow, "A Contribution to the Theory of Economic Growth", Quarterly Journal of Economics, 1956.

2) See e.g. S.C. Tsiang, "A Model of Economic Growth in Rostovian Stages", Econometrica, 1964, p. 621.

On the other hand, we meet, in particular in growth models explicitely concerned with agriculture during the first phases of an industrialization process, the notion of "conventional subsistence wages", or "institutionally" determined wages. The main source of inspiration for this line of thought is Arthur Lewis's well-known article on economic development with unlimited supplies of labour.[1] Lewis takes for granted that "marginal productivity is zero or negligible"[2] and that "the price of labour, in these economies, is a wage at the subsistence level (we define this later)".[3] Lewis himself was not too precise, however, in defining the subsistence wage level. "The classical economists used to think of the wage as being determined by what is required for subsistence consumption, and this may be the right solution in some cases. However, in economies where the majority of the people are peasant farmers working on their own land", Lewis said,[4] "the minimum at which labour can be had is now set by the average product of the farmer". If, however, rents have to be paid, this "objective standard" does not work because "in overpopulated countries the rent will probably be adjusted so as to leave them just enough for a conventional level of subsistence".[4] He adds that "It is not, however, of great importance to the argument whether earnings in the subsistence sector are determined objectively by the level of peasants productivity, or subjectively in terms of a conventional standard of living".[4] Fei & Ranis[5] have presented a more precise version of Lewis's wage theory assuming that when development (i.e. industrialization) starts, wages are equal to the average agricultural product, and that wages (agricultural as well as industrial) stay at this initial level due to some unspecified institutional mechanism until agriculture becomes what they call "commercialized", i.e. until marginal productivity of farm labour begins to exceed this institutionally (or conven-

1) W.A. Lewis, "Economic Development with Unlimited Supplies of Labour", The Manchester School, 1954, here quoted from the reprint in B. Okun & R.W. Richardson, Ed., Studies in Economic Development, New York 1961. See also the penetrating analysis of Nicholas Georgescu-Roegen, "Economic Theory and Agrarian Economics", Oxford Economic Papers, 1960.

2) Lewis, op.cit., p. 281.

3) Ibid. p. 281.

4) Ibid. p. 284.

5) G. Ranis & C.H. Fei, "A Theory of Economic Development", The American Economic Review, 1961.

tionally, whatever it may be) given level. From this "stage" onwards the marginal productivity theory is supposed to hold.

The aim of the present paper is to study these notions of wage determination somewhat on the background of information available about wages in Egyptian agriculture.

2. Two Hypotheses of Agricultural Wage Determination.

In order to confront the abovementioned theories of wages with empirical data we have to specify the theories more concretely as statistical hypotheses.

The marginal productivity theory says that

$$(1) \qquad w = pf'_L$$

where w is the money wage rate, p is the (average) price for agricultural outputs, f is the production function for agriculture, and f'_L is the marginal productivity of labour. For the sake of simplification in measurements, we shall assume that the production function is of the Cobb-Douglas type. This production function has the important property that the marginal product of any factor is a given fraction of the average product of the factor. In case of labour, we therefore have $f'_L = af/L$, $0 < a < 1$, L being the labour input, which permits us to write (1) as

$$(2) \qquad w = a \frac{pf}{L},$$

in other words the wage rate is a certain fraction of the value of agricultural output per unit of labour. Adding a time subscript, t, to all variables in (2) and assuming a to be constant over time[1] we obtain after division

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1) Equation (3) holds even if we assume that the production function is dependent upon time according to the specification $f = g(t)\, L^a$ ..... Let it be added that the production functions which have been estimated on time series statistics from Egyptian agriculture have all of them, so far as I know, actually been of the Cobb-Douglas type and they show no significant influence from time, see M.M. El Imam, "A Production Function for Egyptian Agriculture 1913-55", Memo.No. 259, INP, Cairo 1962, Hanaa Kheir El Din, "The Cotton Production Function in the UAR and its Relation to Technical Progress and to Disguised Unemployment", Memo.No. 370, INP, Cairo 1963, and Bent Hansen, "Cotton vs. Grains On the Optimal Allocation of (cont.)

(3) $$\frac{W_t}{W_o} = \frac{p_t f_t / L_t}{p_o f_o / L_o} = \frac{O_t / L_t}{O_o / L_o}$$

where O is the total value of output. Eq.(3) says that an index of wage rates, say W_t, and an index of the value of output per unit of labour, $(O/L)_t$, the two indexes having the same basis, i.e. $W_o = (O/L)_o = 100$, shall always be equal, i.e.

(3') $$W_t = (O/L)_t .$$

(cont.)

Agricultural Land", Agricultural Research Papers, Seminar on Economics of Industrialization of Cotton, Ministry of Scientific Research, Cairo 1964. That time does not show any significant influence does not necessarily mean that no technical progress has taken place in Egyptian agriculture since 1914 but rather that technical progress has been "embedded" (in Solow's sense) in the factor fertilizer which is explicitely included in the production functions estimated.

On a cross-sectional basis linear functions have been applied, see Saad El Hanafy, "Technical and Economical Study for the Optimum Utilization of the Underground Water", submitted to Regional Planning Project of Asswan.

Colin Clark & M.R. Haswell, The Economics of Subsistence Agriculture, London 1964, p. 99, have called attention to a hypothesis suggested by Leroi-Beaulieu to the effect that the share of rents in total product value is higher the larger is the density of population. Clark & Haswell have produced a scatter-diagram, op.cit. p. 100, where the rent as a percentage of gross product of agriculture is plotted against active agricultural population: persons/hectar for 14 provinces of Egypt. This diagram seems to support the hypothesis of Leroi-Beaulieu. Letting A denote area and L labour and f(A,L) the production function, the diagram of Clark & Haswell suggests the relation

$$\frac{A f'_A}{f} = h \frac{L}{A} , \qquad h \text{ being a constant} > 0.$$

Adding the requirement that f be homogeneous of degree one in A and L the corresponding production function is

$$f(A,L) = aLe^{-h\frac{L}{A}}$$

Clark & Haswell do not draw this conclusion but seem rather inclined to consider Leroi-Beaulieu's hypothesis as a modification - due to lack of competition for labour - to the constant distribution which would follow from the Cobb-Douglas function under perfect competition. In the particular case, this is not a very satisfactory explanation, however, because Clark & Haswell themselves argue that competition for labour from Cairo and Alexandria is responsible for a difference in the level of the share of rents in the Delta and Upper Egypt. Also Clark & Haswell seem to have erroneous ideas about the geography of Egypt. Nevertheless, the diagram of Clark & Haswell is highly suggestive and would deserve a closer study.

We can then formulate the statistical hypothesis -

$$(4) \qquad W_t = \alpha + \beta (O/L)_t + u_t, \qquad E\alpha = 0, \quad E\beta = 1, \text{ and } Eu = 0,$$

where u_t is a random variable. (4) is the hypothesis we are going to test. In order to avoid possible influences from trends, which do make themselves felt to some extent in the time series to be used, we shall alternatively test the same hypothesis formulated on the basis of the first-differences

$$(4') \qquad \Delta W_t = \alpha + \beta \Delta (O/L)_t + u_t, \qquad E\alpha = 0, \quad E\beta = 1, \text{ and } Eu = 0.$$

To form a testable hypothesis corresponding to the institutional subsistence wage theory is more intricate. Its advocates usually avoid specifying exactly which conventional or institutional factors determine the real wages and how, and this makes it of course rather difficult to test the theory. Do, for instance, the wage determining institutional factors change over time?[1] Here we shall follow Fei & Ranis in so far as we simply assume that real wages in the sense money wage rates over a relevant cost-of-living index, P, are constant over time, i.e.

$$(5) \qquad \frac{W}{P} = k,$$

k being a positive constant. Egypt, on which we shall test our hypotheses has never (in historical time, at least, and this means 5.000 years) enjoyed the experience of a state where the majority of the people were peasants working on their own land. From ancient times until 1880 the land belonged to the Sovereign and - directly or through feudal intermediaries of various kinds - exhorbitant rents and taxes as well as corvé-labour were squeezed out of the majority of small peasants, who were no more than serfs and had at most an uncertain right of usufruct.[2]

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1) Georgescu-Roegen, op.cit. p. 17, speaks about a "minimum standard of living" which is supposed to be "historically determined, and consequently susceptible of being changed by economic policy".

2) See A.N. Poliak, Feudalism in Egypt, Syria, Palestine and the Lebanon, 1250-1900, London 1939.

Even after 1880[1] when private ownership to land was definitely established and the corvé was subsequently abolished a substantial part of the land has been cultivated by tenants and there has always existed a class of landless rural labourers. It is therefore impossible to follow the method of procedure adopted by Fei & Ranis, and indicated by Lewis: to let the institutionally fixed real wages be determined by the average productivity for farm population in an initial state[2] where the society consists of independent peasants.[3] The only thing we can do is to assume that real wages equal a certain given constant, k. Writing (5) as $w = kP$, adding time subscripts, and forming indexes we obtain

$$(5') \qquad W_t = P_t$$

where P_t is a cost-of-living index with $P_o = 100$. We reach in this way the statistical hypothesis

$$(6) \qquad W_t = \alpha + \beta P_t + u_t, \qquad E\alpha = 0, \quad E\beta = 1, \quad \text{and} \quad Eu = 0,$$

and alternatively,

$$(6') \qquad \Delta W_t = \alpha + \beta \Delta P_t + u_t, \qquad E\alpha = 0, \quad E\beta = 1, \quad \text{and} \quad Eu = 0.$$

Concerning the cost-of-living for agricultural labourers, two methods have been applied. The first one is to let the cost-of-living be represented by the price of maize, P_M, maize being the main item in the

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1) Actually the introduction of private ownership to land in Egypt was a gradual process which took its beginning some fifty years earlier, but 1880 is the year when most landowners had obtained full ownership rights, see G.Baer, A History of Landownership in Egypt 1800-1950, London 1962, p.11. The general corvé was definitely abolished 1892; before 1892 it is hardly possible to talk about a market for agricultural labour.

2) This idyllic state seems to play something of the same rôle in modern growth theory as Robinson Crusoe played for early utility theory.

3) Observe that in (2) we divide by the total labour force, L, including landless labourers.

agricultural labourer's poor diet; in doing this, I have followed a method adopted by Colin Clark & M.R. Haswell[1] namely to concentrate on the grain-equivalent of rural wages. This method, however, hardly does justice to the institutional subsistence wage theory when agriculture has become capitalistic[2] to the extent which is the case in Egypt since the end of the last century, and when wages are paid in cash[3]. After all, even the most miserable agricultural labourers do spend on other things than grain and grain products, which in Egypt in 1958/59[4] seem to occupy less than halfof their budget. I have therefore, secondly, used a regular cost-of-living index, P_C, for agricultural labourers, specially made for this study. We obtain in this way two different estimates (a) and (b) of eq. (6) and (6').

In econometric studies of wage determination it is usual to assume lags between the explanatory variables and wages,[5] and it is natural to make experiments with lags also in this case. Since there will also be strong trends between wages and the lagged explanatory variables, resp., if we work with the original data, the lagged equations were only estimated on the first differences, and only for output value per man and cost-of-living. It will be understood that on a distributed lags hypothesis β should be expected to be somewhat smaller than 1.[6]

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1) Colin Clark & M.R. Haswell, op.cit., Chap.VII.

2) If Fei & Ranis, op.cit., had not already used the word "commercialized" in another meaning (see above), I would have preferred this term.

3) Payment in kind occurs frequently, but payment in cash is more usual nowadays. Earlier payment in kind was of course dominating, but it is difficult to say exactly when the balance has shifted in favour of cash payment, since this has been a gradual, drawnout process. M.A. Lambert, "Les salariés dans l'entreprise agricole egyptienne", L'Egypte Contemporaine, 1943, mentions that at that time there was a strong tendency to replace payment in kind by cash payment. In the beginning of the period 1914-61, which we shall study, payment in kind may therefore quite well have been dominating. No information is available about the size and development of payment in kind, however.

4) This is the only year for which systematic information of household expenditure for the lowest income brackets in rural districts is available. Before and during World War II the Fellah Department collected information about expenditures of cultivators, but to judge from the size of total expenditures the information pertain to average cultivators with a standard far above that of the labourers, see M.A. Anis, "A Study in the National Income of Egypt", L'Egypte Contemporaine 1950, p. 756.

5) See e.g. L.R. Klein, An Econometric Model of the United Kingdom, 1961, pp. 99, amd 114 f.

6) The sum of all β's should be equal to one.

3. Results of Time Series Analysis.

In the Statistical Appendix I have explained the statistical material in some detail. Here it shall only briefly be mentioned that the wage index is based on information about the annual averages of daily wages for agricultural labourers in the 17 years 1914, 1920, 1928, 1929, 1933, 1934, 1937-1939, 1941, 1943, 1945, 1950, 1951, 1955, 1956, 1959, 1960 and 1961. The information about daily wages was compiled from various sources and is of varying quality. I have not been able to find serious, comparable wage estimates for other years than those enlisted above. The reader may even find that I have gone too far in my efforts to piece together a wage index from the scattered information available. The value of output per unit of labour was arrived at by dividing an index of the value of output by an index of the total labour force in agriculture. Concerning the total value of output very reliable estimates from 1914 to 1961 are available, their main defect being that from 1914 to 1939 vegetables and fruit, fodder and animal production are not included. Since the area under vegetables and fruit as well as the number of animals increased relatively to the production of field crops during this period a certain downward bias in our index of value of output per labour unit seems likely before 1939; this bias is probably small, however, the size of fruit and vegetable production being small at that time, while the stock of animals seems only to have increased slightly more than production of field crops. The labour force index is based on the population census figures for persons economically active in agriculture and annual figures, based on registrations, for rural and urban population; this is the only labour input index available and it is obviously not an ideal index. The price of maize gave rise to a special problem in that two different series were available: one which is used in calculating the value of agricultural output and shows the estimated average price obtained by the producers, and another one which is used in calculating the special cost-of-living index and is based on the wholesale quotations at the grain markets in Cairo (and Alexandria). Estimates were made with both series and the latter one which showed by far the highest correlation with wages was preferred.[1] Concerning the special cost-of-living index reference is made

1) A priori this would also seem to be the appropriate price to use in discussions of the real wages of rural labourers. The reason why producers' average prices in certain years deviate seriously from the wholesale market prices is, inter alia, that the Government has bought part of the crop at fixed support prices, higher or lower than the market prices. When labourers buy directly from farmers the prices charged may be supposed to follow the market prices rather than the Government's buying prices. - It may be added here that although the wage data for the earlier years are rather shaky, the weakest part of the primary information on which this study is based is probably the price data behind the estimates of the output value.

to the Statistical Appendix.

The estimates based on the original observations are then, r being the estimated coefficient of correlation, δ the standard error of the estimate, and the figures in brackets under the value of α and β their estimated standard errors (scatter-diagrams in Graph 1 and Graph 2):

$$(4)^{x} \qquad W'_t = \underset{(15.21)}{31.31} + \underset{(0.05)}{0.88}\,(O/L)_t \qquad r = 0.973 \qquad \delta = 32.00$$

$$(6)^{x} \quad \begin{cases} a) & W'_t = \underset{(32.74)}{-5.09} + \underset{(0.16)}{1.33}\,(P_M)_t & r = 0.907 & \delta = 57.63 \\ b) & W'_t = \underset{(26.88)}{-21.5} + \underset{(0.13)}{1.41}\,(P_C)_t & r = 0.941 & \delta = 46.25 \end{cases}$$

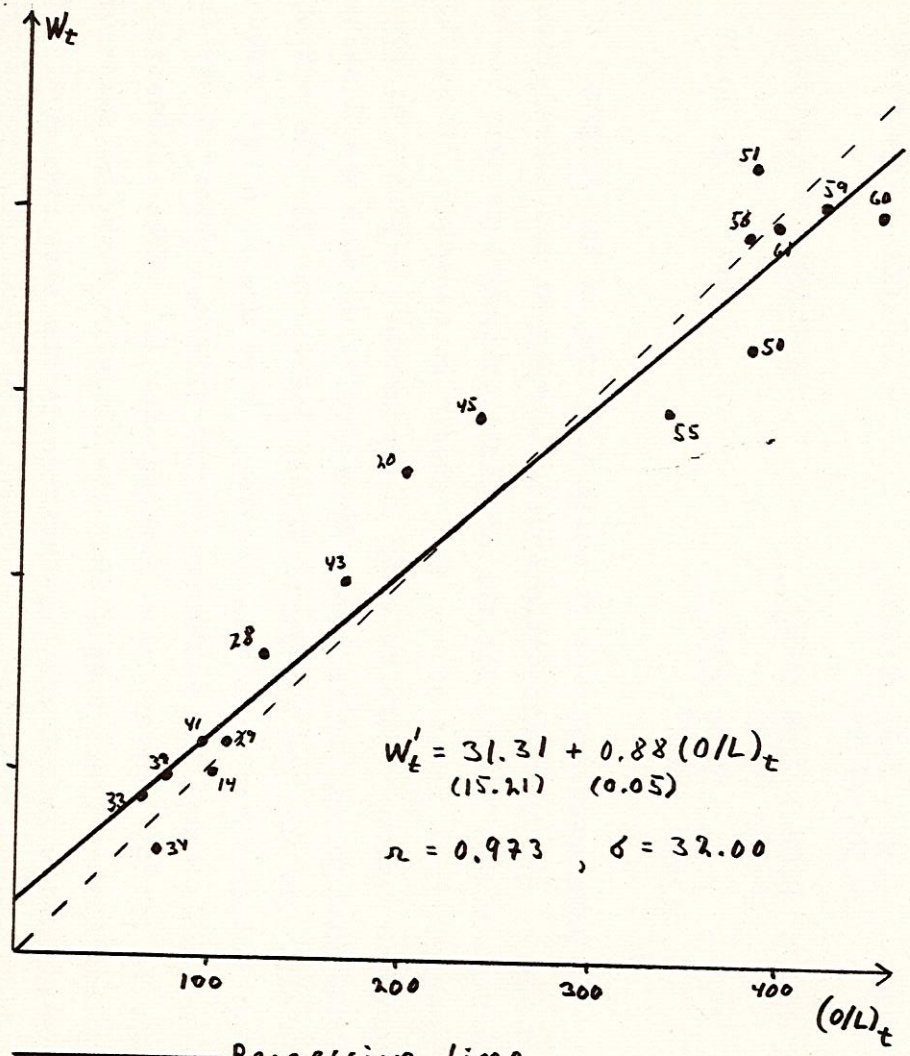
For the first-differences we get:

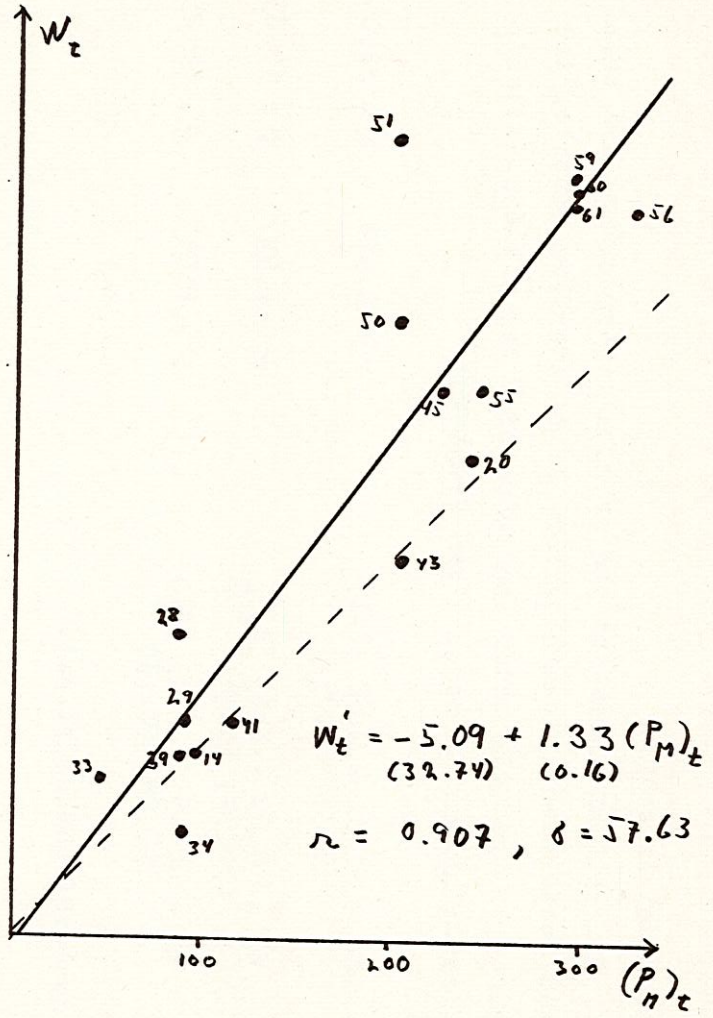
$$(4')^{x} \qquad \Delta W'_t = \underset{(14.50)}{1.30} + \underset{(0.24)}{0.91}\,\Delta(O/L)_t \qquad r = 0.712 \qquad \delta = 55.18$$

$$(6')^{x} \quad \begin{cases} a) & \Delta W'_t = \underset{(16.24)}{9.98} + \underset{(0.25)}{0.68}\,\Delta(P_M)_t & r = 0.584 & \delta = 63.80 \\ b) & \Delta W'_t = \underset{(15.43)}{7.11} + \underset{(0.27)}{0.86}\,\Delta(P_C)_t & r = 0.645 & \delta = 60.08 \end{cases}$$

We have here two sets of estimates, one on the original 17 observations and one on the 16 first-differences. Looking at the correlation coefficients we find higher values for the original observations than for the first-differences. This is of course what should be expected, in particular because there are trends in the original observations. A glance at the scatter-diagrams shows that in all three cases the majority of dots are concentrated in two clusters, one for the pre-World War II years, one for the post-World War II years; within these clusters, however, there are no clear trends. The existence of trends makes the estimates on the original observations less interesting. We notice, anyway, that although for all three estimates the correlation coefficients are significant the estimate with the value of the marginal productivity as explanatory variable is the best from most points of view. The correlation coefficient is highest (and very high, indeed) while the standard error of the estimate is lowest; the estimated value of β is much nearer to the theoretical value, 1, and the estimated standard errors of α and β much smaller than when the price of maize or the cost-of-living are used

Graph 1





——— Regression Line

– – – – – Theoretical Line