

SURPLUS LABOR IN AGRICULTURE AND THE
THEORY OF DISGUISED UNEMPLOYMENT:
EMPIRICAL EVIDENCE FROM EGYPT,
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Reprinted from *The Indian Journal of Economics*,
Vol. LXIII, Part I, No. 248, July, 1982

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ABSTRACT

The theory of disguised unemployment stipulates that in the agricultural sector of labor surplus economics, the marginal product of labor is zero or very near so. Labor in agriculture is thus paid a wage equal to its average product and this creates a disequilibrium in terms of sectoral wages in agriculture and industry. This disequilibrium is responsible for inter-sectoral migration between agriculture and industry so as to equalise ex-ante sectoral marginal products and hence wages. This would lead to global efficiency in the sectoral allocation of labor in labor surplus economics.

Empirical evidence in India and Egypt show that disguised unemployment is not a prevalent feature in labor surplus economics. This evidence is further partially augmented by research by the author in Western Nigeria which show positive marginal product of labor in agriculture though a considerable amount of surplus labor was found to exist. The Nigerian evidence shows that zero marginal product of labor is necessary but not sufficient condition for the presence of disguised unemployment and hence surplus labor in agriculture.

1. Theory

In the theories of development propounded by Sir, Authur Lewis,¹ J.C.H. Fei and G. Ranis,² R. F. Findlay,³ D. Jorgenson⁴ etal, agriculture was characterised by three assumptions to wit :

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- (a) The institutional frame work was uniform across each sector.
- (b) Labor is paid a subsistence wage whose level is determined by tradition or related in some way to its average product.
- (c) disguised unemployment . . . a situation where the marginal product of labor is zero . . . prevails in the whole sector.

In the models they use, the allocation of resources within agriculture is inefficient because of the unfavourable endowment of land and capital. The process of economic development would lead to a re-allocation of factors of production between the agricultural and industrial sector, labor moving to the industrial sector and thus correcting the original adverse labor land ratio that was responsible for inefficiency in agriculture.

The models of Lewis, Ranis and Fei, depict economic development as essentially a process of re-allocation of labor from the over-populated agricultural sector to the growing industrial sector. Agriculture provides both labor and the funds for investment in industry. The wage differential between the agricultural sector and the industrial sector and the increased agricultural productivity consequent on the withdrawal of labor from agriculture both work to activate economic expansion. The wage differential plays this role by serving as inducement for outmigration. Increased agricultural productivity, on the other hand, enlarges the amount of "surplus" originating in agriculture which is available for investment in industry and by moving the terms of trade in favor of industrial goods increases the real income of industrial workers. This increment in income further widens the gap between agricultural and industrial wages and encourages an outmigration of labor from agriculture to industry.

Criticisms were levelled against the concept of disguised unemployment after Lewis, Ranis and Fei. Shultz⁵ showed that traditional agriculture, although poor, was efficient; disguised unemployment was not a feature in under-developed economics. Paglin⁶ and Hansen⁷ among many economists defended the same proposition.

Methodology and Evidence From Egypt and India

Shultz and Paglin concluded that there is no surplus labor in Indian agriculture. Hansen did not find surplus labor in Egyptian agriculture. These investigations however use highly aggregated data. Shultz's data were at state level and Paglin's were derived from group averages for different farm sizes in various state. It is possible that a more disaggregated data would reveal the presence of surplus labor in India and Egypt.

Empirical evidence thus accumulated from India and Egypt do not support either Shultz or Lewis completely. They reveal these features in both countries:

While marginal productivity theory explains agricultural wages, disguised unemployment does occur in some places but is not a prevalent feature of agriculture in "over-populated" countries.

Hansen tested the hypothesis that wages were a function of marginal revenue products against alternative hypothesis that wages were a function of average product for Egypt using time series data of daily wages for agricultural laborers in 17 years (1914, 1920, 1928-29, 1933-34, 1937, 1939, 1941, 1943, 1945, 1950-51, 1955-56, 1959, 1961.) Hansen used two equations in testing his hypothesis, one related in a linear function wages to an average product of labor index and the other related wages to a price (cost of living) index.

$$(1) \quad Wt = a + \beta (O/L) t + ut$$

$$a=0, \beta=1 \text{ and } E(u) = 0$$

$$(2) \quad Wt = a + \beta Pt = Ut$$

$$a=0, \beta=1 \text{ and } E(u) = 0$$

where Wt = wage rate at time t

O = Output

L = Labor force.

The first equation corresponds to the marginal productivity theory of wages and the second to the subsistence wage payment.⁸ The result of the test supports the marginal productivity theory of wage payments for Egypt. The correlation co-efficient

for the first equation was the highest while the standard error of estimate was the lowest. The estimated value of β (for the marginal productivity theory) was much nearer the theoretical value of unity and the estimated standard errors of β and a for the same equation were much smaller than when the price of maize or the cost of living were used as explanatory variables.

Mazumdar and Desai⁹ used the estimating equations of output as a function of human labor, implements and bullock labor. The equations were normalized to prevent heteroscedasticity.

$$(3) \quad \frac{g}{a} = f\left(\frac{L}{a}, \frac{K}{a}, \frac{B}{a}\right) \quad \text{in linear and log forms}$$

Where g = value of total output

L = total labor input

K = value of major and minor implements

a = size of cultivating unit in number of acres

and B = hours of Bullock labor.

They disaggregated their data into (a) farms employing hired labor (b) farms employing only family labor. The results of the test was striking as the co-efficients of labor input in (a) were statistically significant from zero while those for (b) were statistically insignificant from zero.

The work of Mazumdar and Desai help illustrate the nature of dualism in agriculture. A modern sector pays labor its marginal product and a traditional sector pays an institutional wage less than the wage in the modern sector. In dualistic agricultural economics, there is gain from a re-allocation of resources, since a necessary condition for pareto optimality, given constant returns to scale, is that the marginal product of each factor be equated among all sectors.

Thus evidence in India and Egypt as shown do support marginal productivity wage payment. The evidence however does not preclude the possibility of disguised unemployment as shown in the more authentic research of Mazumdar and Desai.¹⁰ The traditional agricultural sector showed zero marginal productivity of labor thus indicating the presence of disguised unemployment and surplus labor.

Methodology and Evidence From Nigeria

The author conducted farm research in Western Nigeria in 1973. Data on output, value of equipments, size of cultivating units, amount of labor employed in labor months, value of fertilizers used were collected from two hundred farm families around Ibadan and Ife districts in Western Nigeria. With these data Cobb-Douglas production functions were estimated.

$$Y = e^{\alpha} L^{\beta} A^{\gamma} K^{\delta} F^{\epsilon}$$

for which

$$\log Y = \alpha + \beta \log L + \gamma \log A + \delta \log K + \epsilon \log F$$

where Y = income (total output)

L = labor months applied

A = total acres cultivated per farmer

K = value of equipments

F = value of fertilizers

The estimated production function was:

Log	$\gamma = 4.2317$	$+0.2051$	$\log K$	$+0.1548 \log A$
Standard error	(0.1938)	(0.0538)		(0.0364)
t-statistics	(21.8363)	(3.8115)		(4.2235)
		$0.2939 \log L$	$+0.0015 \log F$	
standard error		(0.0667)		(0.0082)
t statistics		(4.4066)		(0.1869)

The co-efficients of labor, as well as those of capital and land were statistically significant from zero at the one percent confidence level. This shows positive marginal product of labor. This however does not indicate the absence of surplus labor in the relevant agricultural sector.

In order to show that disguised unemployment and hence that surplus labor does not exist in the sector investigated an estimate of the marginal product opportunity cost ratio of labor was made. Maximum efficiency in resource use occurs when its marginal product/opportunity cost ratio is equal to unity. If the ratio is less than one, it indicates that too much of the particular resource is being utilised, if the ratio is greater than one, it indic-

ates that too little of the resource is being used. Efficiency would dictate the purchase and use of more of that particular resource or factor.

In the sector of Western Nigeria investigated the marginal product-opportunity cost ratio was less than one (numerical value attained was 0.35)¹¹ This shows the presence of considerable, surplus labor and hence disguised unemployment in the agricultural sector.

Conclusions

Hansen used highly aggregated data and thus could not find evidence for disguised unemployment in Egypt. A use of disaggregated data at the farm level would point to the presence of disguised unemployment and as such reveal a potential source of savings for industrial and agricultural development in over-populated economics.

This disaggregation by the use of Cobb-Douglas cross-section analysis in the work of Mazumdar and Desai pointed to the presence of disguised unemployment in the traditional sector of Indian agriculture. This finding was further buttressed by the evidence from Western Nigeria. The marginal product/opportunity cost ratio for labor was less than unity showing the presence of surplus labor in the agricultural sector.

The research in Western Nigeria shows that the marginal product of labor was positive and significant and as such that zero marginal product of labour is necessary but not sufficient condition for the presence of surplus labor.

The presence of surplus labor in the agricultural sector of over-populated regions means economic development could proceed with inter-sectoral migration from agriculture to industry. The surplus labor in agriculture moving to the industrial sector would achieve exactly the same solution as postulated by Lewis, Ranis and Fei (above) in their theory of dualism with respect to over-populated regions. It would lead to a Pareto optimal solution by tending to equalise the sectoral marginal products of labor and enhancing efficiency in the agricultural sector.

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8. Using a Cobb-Douglas production function, the marginal product of any factor is a given fraction of its average product,

$$W = \frac{apf}{L} \text{ Where } 0 < A < 1 \text{ and}$$

pf = average revenue product

L = labor force

Assuming that 'a' is constant over time and using a time subscript,

$$\frac{W_t}{W_0} = \frac{P_t F_t I_t}{P_0 F_0 I_0} = \frac{O_t I_t}{O_0 I_0}$$

Using $W_0 = O_0 = 100$. i.e. the base period of a wage index, it follows that $W_t = (O_t/L) +$. The specifications of the equations by Hansen are thus

(a) $w_t = a + \beta(O_t/L) + ut, a=0, \beta=1$ and $E(u) = 0$

(b) $w_t = a + \beta P_t + ut, a=0, \beta=1$ and $E(u) = 0$

9. Desai, M and Mazumdar, D. "A Test of the Hypothesis of Disguised Unemployment" *Economic* Vol. XXXVIII, No. 145, February 1970.
10. Mazumdar and Desai used cross section analysis of data at farm level. Data was thus disaggregated and was more amenable to econometric analysis.
11. Detailed analysis of methodology and data used are contained in Don N. Ike, 'Agricultural Excess population and the Economic Considerations for Land Reform in Nigeria' *Doctoral Dissertation U. C. L. A* 1973. and in "Estimating Agricultural Production Functions for some Families in Western Nigeria" *The Developing Economics* Vol XV No. 1 March 1977 by the same author.