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Market Failure in Determination of Farm Wages: An Empirical Analysis

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Egalitarian and ethical considerations in fixing wages and the political commitment to work towards full employment and to establish a welfare state have encouraged legislation to fix minimum wages and to enforce it. It is through legislation and judicial decision that a wage level and a wage structure compatible with the demands of social justice of ensuring a decent living and equity are being decided. Such efforts have, however, succeeded only in organised sectors where trade union activities are powerful. With a backlog of unemployment and under-employment and due to the practical difficulties in standardising work norms, labour in the agricultural sector hardly gets any benefit from such legislations. In such a situation, the need of an acceptable wage theory becomes imperative.

Still, marginal productivity theory and market theory of wages are found to be more helpful in fixing wages for farm labour. The existing scope for increasing the productivity through improved methods of crop production and efficient use of available labour in agriculture enables the use of marginal productivity theory. With its several restrictive assumptions, this theory is useful at best to determine the ability of the farmer to pay a wage but fails to evaluate its adequacy to satisfy the supply conditions of labour. Disutility resulting from the labour involved, which must be equal to the marginal utility of the wages obtained for such labour, would address to the supply side of the labour market. Therefore, what is called for simplicity the market theory of wages explains that the forces of demand and supply in the farm labour market cause the market wage to fluctuate around an equilibrium wage which clears the market (Hanson, 1972).

Attention to labour as a factor of production should not be at the neglect of social aspect of labour. As a member of the society, the labourer has a claim for a decent living and equity in income and this draws attention to the concepts of a fair wage, a living wage or need based wage. Farm work is the major source of income for a landless agricultural labourer. Wages received by him should help him to have a decent level of living, at least to avoid poverty. This is the welfare criterion, a third dimension in fixing wages.

METHODOLOGY AND DATA BASE

Thus the three criteria considered for determining wages of farm labour are *(i)* marginal value product of labour (defining the highest rate the producer farmer will be willing to pay), *(ii)* minimum wage required to keep the labour at least at the poverty line which is the floor level acceptable to the labour and *(iii)* market equilibrium wage which equates demand for labour with the supply of labour. If the wage determined by the criterion *(iii)* lies between those determined by *(i)* and *(ii)*, it may be acceptable to both the farmers (buyers of labour) and the labour (the seller). The closer to the level determined by *(i)*, called productivity based wage, the better will be the condition of the labourer and the rate will be within the ability of the farmer to pay. If the market wage [*i.e.*, determined by criterion *(iii)*] falls

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outside the range set by *(i)* and *(ii)*, it will hurt either the farmer or the welfare of the labourers and will be unstable. Therefore, this knowledge of wage theories is useful to evaluate wages received by the farm workers for its fairness and stability in any specific market. To empirically verify this statement, a study was done with reference to a sample of rice farms of Tamil Nadu.

For the purpose of analysis, it is necessary first to standardise the measure of labour, that varies by operation, skill and sex, causing variations in wage received. Farm operations are usually performed by both men and women labourers though there are some exceptions like ploughing which is done solely by men, and weeding exclusively done by women. Usually a day's work of eight hours performed by a man (called unskilled worker) is taken as the base and is called a man-day. All other categories of labour are measured, then, in equivalents of man-day based on the prevailing wage rates.

Then labour use is measured in man-days and wage rate is defined for this category. It is not difficult to determine wage for other categories in proportion to the rates currently prevailing. Models used to estimate farm wage in Rs./man-day by the three criteria (discussed above) are presented below.

Marginal Productivity of Farm Labour

Factor-product relationship in a production process like farming could be expressed well by the Cobb-Douglas form of production function as it obeys the Law of Diminishing Returns in its log-log form. So a Cobb-Douglas production function is specified as follows:

$$(1) \qquad V = \prod_{j=1}^{8} AX_j^{Bj} \; e^{u_i} \qquad \text{....Model I}$$

where V = value of the farm output in rupees,
X_1 = gross cropped area of the farm in hectares (ha),
X_2 = value of seed material used in rupees,
X_3 = quantity of nutrients applied in kg,
X_4 = quantity of manures applied in tonnes,
X_5 = quantity of family and permanent labour used in a year in crop production (man-days),
X_6 = quantity of casual labour hired in a year in crop production (man-days),
X_7 = per cent of area irrigated on the farm,
X_8 = value of other resources (bullock power and plant production chemicals) used in one year in crop production in rupees,
B_1 .... B_8 are regression coefficients (elasticities) to be estimated, A is intercept term and u_i is stochastic disturbance term.

From the above model, shadow price or the marginal value product of farm labour could be calculated as:

$MVP \times 5 = B_5 \times \overline{Y}/\overline{X}_5$ for family labour and

$MVP \times 6 = B_6 \times \overline{Y}/\overline{X}_6$ for casual labour.

Annual Demand for Casual Labour in Crop Production

To analyse the behaviour of labour market, major forces of demand and supply were estimated separately. In analysing the demand side of the market, a labour demand function was fitted after a brief review of past works carried out in the field. Whitby and Willis (1978) suggested that the employer's behaviour in labour hiring can be explained in terms of derived demand, *i.e.*, he will be prepared to pay the last worker he hired, what that work will earn for him and no more and this marginal amount is determined by a number of variables including the technical possibilities of substituting labour for other inputs (capital), the price of other factors, the price of the product produced, etc. Kumar *et al.* (1981) also observed that wages, product price and irrigation are the dominant determinants of employment. The negative employment effect of tractorisation, wages and fertiliser price was not offset by the positive employment effect of wheat price and complementary inputs. The wheat price must be sufficiently high to induce output response to cancel the negative employment effect which occurs as a result of rise in wage and other factor prices. Chakravorty (1983) found that the higher the market wage rate, the higher would be the substitution of hired labour by self labour among small farms.

In this study, demand for casual labour was defined to be a function of two types of variables, *viz.*, the economic variables and technical variables. The economic variables included the money wage rate for a man-day, price of the product produced and value of other resources used in production. Similarly, the technical variables included the quantity of family and permanent labour used, gross cropped area of the farm, technology index of the farm and the amount of machine power used.

For simplicity and easy estimation, a multiple linear regression model was constructed as follows:

$$(2) \qquad N = B_0 + \sum_{i=1}^{7} B_i X_i + B_8 D + e_i \qquad \text{.... Model II}$$

where N = quantity of casual labour used (man-days/year)

X_1 = average money wage rate/man-day in rupees,

$$i.e., X_1 = \frac{\text{Wages paid for an unskilled work/month}}{\text{Number of man-days engaged for it/month}}$$

X_2 = weighted average price of the product (Rs./kg)

$$i.e., X_2 = \frac{\sum_{j=1}^{n} Q_i P_i}{\sum_{1=j}^{n} Q_i}$$

P_i = price of product 'i' per kg,

Q_i = quality of the product 'i' marketed (kg),

X_3 = quantity of family and permanent labour used in man-days/year,
X_4 = gross cropped area of the farm in ha,
X_5 = hours of machine power used,
X_6 = technology index of the farm (per cent),

$$i.e., X_6 = \frac{V_i/A_i}{\overline{V}/\overline{A}} \times 100$$

V_i = total value of the product in i-th farm (Rs.),
$\overline{V}$ = mean value of the product produced in all the sample farms (Rs.),
A_i = area cultivated in the i-th farm (ha),
$\overline{A}$ = mean cultivated area in all the sample farms (ha),
X_7 = value of other resources used in crop production in a year (Rs.),
D = 1 if the farm is located in zone I^1 and
0 if the farm is located in zone II,
B is intercept, B_1 - B_8 are the regression coefficients to be estimated and e_i is stochastic factor term which included error of approximation also.

Demand Elasticities

Taking first order derivative of Model II with respect to wage and price will give the marginal demand for labour and the elasticities are worked out as follows:

$$e_1 = \frac{\partial Y}{\partial X_1} \frac{\overline{X}_1}{\overline{Y}}$$ – Wage elasticity of labour demand

$$e_2 = \frac{\partial Y}{\partial X_2} \frac{\overline{X}_2}{\overline{Y}}$$ – Product price elasticity of labour demand

Annual Supply of Labour for Farm Work

After studying the demand side of the farm labour market, supply of labour for farm work was also studied by estimating a household labour supply function. In estimating labour supply, various views have been expressed by previous workers. While analysing the labour supply in agrarian economy, Bardhan (1979) introduced four types of wage variables, *viz.*, *(i)* daily wage rate as calculated by dividing total wages paid by man-days of labour engaged, *(ii)* predicted wage ratio as the ratio between predicted wage rate to induce labour supply and the actual wage received, *(iii)* village wage variable that will represent the general wage rate prevailing in the economy and *(iv)* village expected wage rate as:

$$VEW = V.W (1 - VUR)$$

where V.W = village wage and
VUR = village unemployment rate: $0 < VUR < 1$.

Bardhan (1979) has also derived equations separately for acceptable wage rate and acceptable wage for self-employed.

Booth and Sundrum (1984) used the concept of reservation wage to mean that wage level where supply of labour will be elastic and at least upto that amount of employment which represents the maximum number of hours which the particular labour force under consideration is willing to work.

Borjas (1980), while estimating a labour supply function, presented new evidence strongly questioning the result that the elasticity of weekly hours of work with respect to the wage rate was negative.

Labour supply in the landless labour households would be determined by the decision taken by the members collectively on working or net working. Following Bardhan (1979), a household labour supply function in the linear form was fitted as follows (see Senthilnathan, 1987):

$$(3) \quad S = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + e_i \qquad \text{.... Model III}$$

where S = labour supplied to farm work (man-days/year),

x_1 = average wage received per man-day of work

$$x_1 = \left[\frac{\text{Total earnings received from all farm work/year}}{\text{Man-days of labour supplied to farm work/year}}\right],$$

x_2 = labour force available in the household (per cent),

$$x_2 = \left[\frac{\text{Total number of working persons in the household}}{\text{Total number of persons in the household}} \times 100\right],$$

x_3 = labour supplied to non-farm work (man-days/year),

x_4 = annual income of the household (Rs.)

a is constant term, b_1 to b_4 are partial coefficients to be estimated and e_i is disturbance term.

First order derivative of the model would give marginal supply and from that wage elasticity of labour supply is worked as follows:

$$e = \frac{\partial s}{\partial X_1} \frac{\bar{X}_1}{\bar{s}}$$

Since the present study made use of the secondary data already collected from the fields, inclusion of such variables as predicted wage rate, expected wage rate and reservation wages which are of hypothetical nature was not attempted.

Data Base[2]

Required data regarding labour use pattern, resources used in crop production and crop yields on the farms and supply pattern of labour and levels of living of landless labour

households were obtained from the Project Report of the Department of Agricultural Economics, Tamil Nadu Agricultural University (1986). The sample size was restricted to 100 in the case of farms and 50 in the case of landless labour households, distributed over Salem (zone I) and Dharmapuri (zone II) districts of Tamil Nadu.

RESULTS OF ESTIMATION

The specified models were estimated by using the ordinary least squares (OLS) method and the results are presented in Tables I to III. As could be seen from Table I, 87.4 per cent of the variation in the value of product could be explained by the selected variables and the equation showed a good fit. Variables like gross cropped area, quantity of manures used, quantity of family and casual labour used had significant positive effect on the product value. From the value of the coefficients it is clear that total value product would increase, *ceteris paribus*, by 19.4 per cent and 27.4 per cent if the quantity of family labour and casual labour use was doubled (100 per cent increase) respectively from their mean levels.

MVP of family labour = Rs. 15.12/man-day. MVP of casual labour = Rs. 15.72/man-day. These two wages were above the mean wage of Rs. 11.69 paid to labour in the study area.

TABLE I. ESTIMATES OF MODEL I (WHOLE FARM PRODUCTION FUNCTION)

Sr.No.	Variable	Regression coefficient	S.E.	't'	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
1.	Intercept	4.9023	0.4971	9.8624	*
2.	X_1	0.2178	0.0785	2.7740	*
3.	X_2	0.1145	0.0704	1.6256	N.S.
4.	X_3	0.0965	0.0472	2.0427	**
5.	X_4	0.0222	0.0225	0.9874	N.S.
6.	X_5	0.1943	0.0392	4.9452	*
7.	X_6	0.2739	0.0623	4.3977	*
8.	X_7	-0.0026	0.0206	0.2240	N.S.
9.	X_8	0.0641	0.0860	0.7458	N.S.
	$R^2 = 0.8742$**; N = 100; F = 79.0243.				

* Significant at 1 per cent level.
** Significant at 5 per cent level.
N.S.=Non-significant.

The results presented in Table II would show that 67.6 per cent of the variation in demand for casual labour was explained by the selected variables. Weighted average price of the product, technology index of the farm and other expenses made on the farm had significant effect on the labour demand. An increase in the price of the product by one rupee per kg would, *ceteris paribus*, increase the demand for casual labour by 30 man-days, and an increase in the technology index by 10 per cent would increase the demand for casual labour by six man-days. Similarly, an increase in the expenses made on bullock power, irrigation and plant protection chemical by one hundred rupees would be associated with an increase in demand for casual labour by 3.5 man-days. Here the effect of wage on demand for labour was not significant.

Wage elasticity of demand = $0.21778^{N.S.}$. Price elasticity of demand = 0.53849*.

TABLE II. ESTIMATES OF MODEL II (LABOUR DEMAND)

Sr.No.	Variable	Regression coefficient	S.E.	't'	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
1.	Intercept	-45.5338	44.2764	-1.0284	N.S.
2.	X_1	-2.9665	3.0952	-0.9584	N.S.
3.	X_2	30.0857	12.6062	2.3865	N.S.
4.	X_3	-0.0886	0.2157	-0.4114	N.S.
5.	X_4	3.5490	9.5640	0.3711	N.S.
6.	X_5	-2.0342	1.5249	-1.3348	N.S.
7.	X_6	0.6110	0.1860	3.2852	*
8.	X_7	0.0353	0.0130	2.7233	*
9.	D	14.6677	23.2430	0.6311	N.S.
	$R^2 = 0.6761$**; N = 97; F = 22.9572.				

* Significant at 1 per cent level.
N.S.=Non-significant.

The estimates of Model III (Table III) showed that only 34.5 per cent of the variation in the labour supply for farm work was explained by the selected variables; however, the estimated equation was statistically significant and could be used for analysis. Average wages received per man-day, the quantity of labour supplied to non-farm work and annual income of the household had significant influence on the supply of labour. One rupee increase in farm wage rate would increase the supply by 6.3 man-days, *ceteris paribus*; an increase in the labour force availability in the labour households by 10 per cent would increase the supply by 4.5 man-days; the quantity of labour supplied would decrease by 1.2 man-day and 1.65 man-day when the quantity supplied to non-farm work and annual income of the household increased by 10 man-days and Rs. 100 respectively.

TABLE III. ESTIMATES OF MODEL III (SUPPLY OF LABOUR)

Sr.No.	Variable	Regression coefficient	S.E.	't'	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
1.	Intercept	177.3279	42.1796	4.2041	*
2.	X_1	6.2743	2.4392	2.5723	*
3.	X_2	0.4509	0.2887	1.5616	N.S.
4.	X_3	-0.1183	0.0441	-2.6776	*
5.	X_4	-0.0165	0.0062	-2.6533	*
	$R^2 = 0.3450$*; N = 50; F = 5.9257.				

* Significant at 1 per cent level.
N.S.=Non-significant.

Market Equilibrium Wage

The estimated labour demand and supply equations are:

$$Y = -19.2166 - 1.25169\,X_1 + 12.6944\,X_2 - 0.03744\,X_3 + 1.49746\,X_4 - 0.85883\,X_5 + 0.2578\,X_6 + 0.0148976\,X_7 + 6.18896\,X_8 + e_i$$

$$S = 177.3279 + 6.274285\,X_1 + 0.4508605\,X_2 - 0.1180\,X_3 - 0.016516\,X_4 + e_i$$

Substituting the mean values for all other variables in the two equations and assuming that the error terms in the equations were distributed normally with zero mean, the market clearing value X_1, *i.e.*, the wage rate worked out to Rs. 10.62. It was equilibrium wage rate, given the demand-supply conditions in the labour market. It should be specifically noted that the average wage rate actually paid to casual farm labour was Rs. 11.69 and higher than the equilibrium wage rate. It implies that the present method of fixing wage rate by tradition and customs is favourable to the hired labourers. Had the labour market acted freely the wage would have fallen to Rs. 10.62 (approximately by one rupee per man-day) due to pressure of unemployed and under-employed labour force.

Minimum Needs Approach of Farm Wages

Farm wages form the major source of income for landless labour households and they should enable them to have a level of living above the poverty line. Among the sample households, only four households were found living at poverty line and the number of days employed per year in those households was found out. Keeping the poverty line income fixed by the government (at 1981-82 prices) as the numerator (Rs. 4,110.88/year/household) and dividing the same by mean number of days of employment (312.38 days), the wage rate required to keep the household at least at poverty line was worked out to Rs. 13.16.

Minimum Wage Based on Consumption Level

Mean annual consumption expenditure of a household living at poverty line was Rs. 3,355.65 and mean number of days of employment was 312.38 and so an approximate (minimum) wage required for a man-day to keep a household above the poverty line was Rs. 10.74. But here consumption expenditure itself is determined by the wages received which is already very low.

Wage Estimates Derived

(i)	Marginal productivity of labour	Rs. 15.72/man-day
(ii)	Market equilibrium wage	Rs. 10.62/man-day
(iii)	Wage which ensures poverty line income	Rs. 13.16/man-day
(iv)	Wage to meet annual consumption expenditure	Rs. 10.74/man-day

CONCLUSION

The striking closeness of *(ii)* and *(iv)* would show that a free labour market condition would keep labour at subsistence level only and that the level of living would be below the decent level defined by the poverty line. Therefore, market failure is evident and policy intervention to determine the wage of farm workers is essential.

Minimum wage to avoid poverty of labour households would be Rs. 13.16 per man-day. Any wage above this but below Rs. 15.72 per man-day (marginal value product) will help the labourers, within the paying capacity of farmers. Therefore, Rs. 14 per man-day (the

simple average of minimum wage and marginal value product) will be a fair wage. All these inferences are subject to the prevailing conditions in markets for farm products and the technology in rice production.

NOTES

1. For details on specification of zones, please refer to the section on data base.
2. For the source of data base, see Tamil Nadu Agricultural University (1986).

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