CHAPTER V

Determination of the Level of Wage Rate in Agriculture

Price of a commodity is governed by the market mechanism - the interaction of demand and supply forces. So should be the case with wage - the price of labour.[1] The logic suggests that agricultural wage rate should also be determined in the labour market through the inter-play of demand for and supply of labour factors.

The purpose of this chapter is to explore:

i) The demand and supply affecting factors that might have affected the level of wage rate in agriculture among the villages in Rajasthan.

ii) Whether the factors significant at village level in determining wage rates, were also significant at district levels.

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1. Hicks, J.R., 'The Theory of Wages' London, 1961, P.1

Methodology, selection of wage affecting variables and hypotheses are discussed in Section I. Section II is devoted to the empirical verification of theoretical relationships. Last Section summarises major findings and points out relevant policy implications.

5.1 Methodology and Hypotheses

A Cross-section analysis is attempted to investigate the variables that might have affected the wage level in agriculture during 1970-71. A time-series analysis was not possible due to non-availability of comparable time-series data on relevant parameters.

Since we do not have data to construct demand and supply functions, we resort to only those factors that might affect demand for and supply of labour. Before we proceed further, it will not be out of place to discuss briefly as to who creates the demand for and the supply of labour in agriculture.

In a developing economy like ours, landless and landpoor predominate labour supply. Small and marginal farmers owning tiny and scattered pieces of land, insufficient in providing round the year work, do hireout labour to augment their meagre incomes. Females and grown-up children also join the stream of labour supply. On certain occasions, village artisans and handicraft families also hire out labour. A basic characteristic of labour force in agriculture is predominance of lower castes, Scheduled Castes and Scheduled Tribes population. Caste-consciousness exerts significant role in controlling the flow of labour force. Generally, large and middle farmers generate demand for labour in agriculture.

5.1.1 Selection of Wage affecting Variables and Hypotheses

Depending upon the availability of relevant and requisite informations, we consider the following factors as wage-determining factors.[2]

(1) Land-man ratio

It refers to gross-sown area available per agricultural worker (cultivators + agricultural labourers). Higher land-man ratio denotes low population pressure on land and thereby higher demand for labour warranting higher wage rates in agriculture. Hence, we may expect positive relationship between land-man ratio and agricultural wage rate.

2(a) Backman, Jules, "Wage Determination, An Analysis of Wage criteria", Princeton, New Jersey, 1959.

(b) Papola, T.S., "Principles of Wage Determination", Somaiya Publications Pvt.Ltd., Bombay, 1970, P.4.

(2) Scheduled Castes and Scheduled Tribes Population

It is measured as percentage of total population of the village. Scheduled Castes and Scheduled Tribes population in Rajasthan was 27.90 percent as against 21.50 percent at national level in 1971. This segment affects rural labour supply most. Hence, it would not be proper to neglect this factor from the study. Many villages covered in this study have a significant proportion of Scheduled Caste population.

Schedule Castes and Scheduled Tribes population may affect wages in two ways. Being almost illiterate and unskilled, they are unable to work in industries and offices. Secondly, they are poor, have no lands and assets to get self employment. As such no alternative is left with them except to hire out labour in agriculture. Higher proportion of Scheduled Castes and Scheduled Tribes population should naturally depress wage rates. This is an indicative of its inverse relationship with agricultural wage rate.

(3) Agricultural Labourers

They are expressed as percentage of total agricultural workers. Labourers hire out their labour; while, cultivators hire-in labour. Former is the supplier, while, latter is the employer of labour. If labourers are larger than cultivators, wage rate would shift down ward. One may expect negative association of labourers with wage rate.

(4) Location and Communication Scores[3]

Transportation, Communication, Electricity and Location facilities (in the form of distance of the village from a nearest town) favourably affect wage rates in agriculture. Each of these four facilities are assigned 10 scores. Appendix V.1 provides a detailed procedure regarding allotment of scores to each of the villages understudy based on the availability of these facilities.

Electricity improves and speeds up irrigation, makes multiple cropping and use of H.Y.V. seeds possible. As such, agricultural activities and production move upward. Demand for labour also increases. Electricity develops non-agricultural sector also and reduces labour supply to that extent for agricultural sector.

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3. Bardhan, K., has used this variable in a bit different manner in an article "Factors Affecting Wage Rate for Agricultural Labourers", published in Economic and Political Weekly, June, 1973, PP.A56 to 64.

Transportation and communication facilities speed up labour mobility; affect level of off-farm employment and reduce labour supply for agriculture. It changes cropping pattern;[4] provides higher values to farmers for agricultural produce and raises their paying capacity.

Distance from the industrial town and centres adversely affects wages in agriculture.[5] Nearer the town, higher the agricultural wage rate. A village more favourably placed in terms of location and communication scores, should have higher wage rates and vice-versa. Though there are numerous such facilities affecting wages; but we could include only a few. Therefore, we may expect positive relationship of moderate degree between wage rate and location scores.

(5) Sex-ratio

Here it refers to female population per hundred male population. Female working population, instead of total female population, would have been a better variable showing influence on wage rate.

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4. Gouri, G.S., his Ph.D. Thesis, University of Bombay, 1952
5. This view is in conformity with the following studies:
   i) Srivastava G.S. Op.Cit. (ii) Desai M.N., Op.Cit.
   iii) Sureshchandra, Op.Cit. (iv) Bardhan K., Op.Cit.June,1973

But the criterion adopted in the Census of India, 1971, for the enumeration of workers, specially for females and that too for agricultural families, could not present a real picture of female workers. During peak seasons, female members of labourer, cultivator, and of artisan families work in agriculture and augment labour supply. But most of the womenfolk have been excluded from the work force on the pretext that their main activities were household duties, and casual working in agriculture were not the main economic and productive activities. Though it is a fact, but it is also a fact that their casual work affects labour supply and thereby wage rates. Therefore, it seems, inclusion of female population instead of female working population in the labour force would be a true and more effective factor affecting wages in agriculture.

Females are unable to handle strenuous operations like ploughing and lifting of water from the well through traditional means. Moreover, females work for lesser hours due to children care. Hence, they are paid low wages than their counter-parts as concluded by some other studies[6] also. Consequently, low wages will exist if females out-number males. This suggests about the negative correlation between sex-ratio and wage

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6. Female wage rate was 62.4 percent and 61.5 percent of male wage rate in 1950-51 and 1956-57 at all India level. Second Agricultural Labour Enquiry, 1956-57, PP.117-119.

rate, i.e., higher the sex-ratio, lower the wage rate and vice-versa.

(6) Literacy Rate

It denotes literate and educated population as percentage of total population. Education and Training improves efficiency and inspires a man for respectable and more lucrative job. After getting training and education, one would hardly like to work in agriculture sector unless adverse circumstances compel. It implies, high rate of literacy would reduce available labour force for agriculture. Literacy affects wages in two ways; firstly, it reduces labour supply, secondly, it requires higher wage rate. We may hypothesize literacy rate to be positively associated with wage rate in agriculture.

(7) Area under Non-food Crops (N.F.Cs.)

This is worked out in terms of percentage of gross-sown areas of the village. N.F.Cs. include other than cereals, pulses and fodder crops.[7] Some of the N.F.Cs. are used as raw materials in industrial sector and bring higher earnings to farmers. Farmers growing N.F.Cs. achieve higher capacity to pay wages. N.F.Cs. like sugarcane and chillies, require frequent irrigations and thereby increase in demand for labour.

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7. Statistical Abstract Rajasthan, 1986, published by the Directorate of Economics and Statistics, Rajasthan, Jaipur, P-37.

This N.F.C%. may affect wages in two ways (i) it raises paying capacity of the farmer; (ii) it increases the demand for labour. One may expect its positive relationship with wage rate.

(8) Irrigation

It represents percentage gross irrigated area to gross-sown area. Irrigation has been accepted unanimously as a key factor boosting agricultural activities and labour demands. This makes multiple cropping and use of H.Y.V. seeds and fertilizers possible. It shifts demand upward indirectly[8] also for the maintenance of irrigation system. In its absence, agricultural activities and dirversification of crops will be limited. Verily, one may expect wage rate to be positively responsive to irrigation.

(9) Cropping Intensity (C.I.)

It is worked out in terms of grosssown area as percentage of net sown area.

$$\frac{(\text{Gross sown area} \times 100)}{\text{Net sown area}}$$

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8. Bardhan, K., Op.Cit., June 1973.

As many times a land is brought under plough, as many times the demand for labour would arise. Higher the C.I., higher would be the demand for labour. This implies an upward shift in wage rate. One may expect C.I. and agricultural wage rates to be positively associated.

Factors placed at serials (1), (4), (7), (8), and (9) influence wages from demand side. We may call demand influencing factors. Factors placed at serials (2), (3), (5) and (6) exert their influence from supply side; and we may call supply affecting factors. Table 5.1 presents village-wise relevant data pertaining to above selected parameters in desired form for the purpose of cross-section analysis.

5.2 Empirical Verification of Proposed Hypotheses

The major and significant task, now, is to test the validity of the proposed hypotheses as discussed above. We, first, resort to correlation analysis.

5.2.1 Correlation Analysis

All the selected variables are quantified as under:

X_1 = Land-man Ratio.

X_2 = S/C and S/T population as percentage of total population.

X_3 = Agricultural labourers as percentage of total agricultural workers.

X_4 = Location and Communication scores.

TABLE 5.1

Economic and Socio-demographic Features (Selected Variables) of Villages Under Study 1970-71

Villages (Wage reporting Centres)	Land-man ratio (Gross sown area per agricultural worker)	S/C and S/T population as % of total population	Agricultural labourers as % of agricultural workers	Location communication scores	Sex-ratio (Female population per 100 male population	Rate of Literacy i.e.% of literate population	Area under Non Food Crops as % of total sown area
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1. Dadiya	4.80	18.62	14.40	17.50	91.79	10.58	15.85
2. Khayra	7.37	17.66	24.17	2.50	88.80	5.79	34.20
3. Salarpur	3.61	26.25	31.19	5.00	105.80	8.03	27.20
4. K.Machri	3.60	35.95	2.05	20.00	92.93	20.36	7.85
5. Kakenseja	4.30	100.00	4.61	10.00	92.68	3.80	15.60
6. Anjana	2.80	51.04	19.51	12.50	113.68	15.94	7.75
7. Bissala	5.88	17.53	6.42	10.00	94.80	16.43	0.25
8. Jagheena	5.55	23.34	19.38	30.00	83.59	17.08	16.75
9. Khanwa	5.18	14.96	15.81	12.50	85.78	22.54	29.30
10.Asind	4.66	24.46	17.98	32.50	89.75	31.31	10.45
11.Bigod	1.82	20.91	28.60	27.50	88.28	19.74	21.25
12.Nathusar (Bikaner)	17.42	14.93	1.79	10.00	83.53	6.73	0.00

TABLE 5.1 (concld.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
24.Bhaisra	14.19	8.88	2.63	10.00	78.14	7.31
25.Panwa	4.46	23.52	56.58	5.00	106.10	10.20
26.Sayla	8.71	25.02	23.01	22.50	97.37	15.87
27.Govindpura	2.35	33.14	22.58	5.00	85.95	3.20
28.Bani	3.89	26.44	25.31	5.00	99.79	18.57
29.Doomra	10.04	16.91	15.54	12.50	94.92	19.78
30.Khinwasar	10.57	16.72	0.00	15.00	91.20	15.94
31.Sekhla	11.59	28.19	5.82	15.00	84.80	10.33
32.Chokri Khurd	4.59	14.15	0.00	12.50	103.71	6.86
33.Dhoti	12.28	54.92	34.15	12.50	85.77	18.82
34.Bamla	9.78	35.06	29.52	25.00	94.83	29.70
35.Jayal	6.94	14.00	3.27	15.00	91.25	17.08
36.Tausar	5.09	4.58	0.67	27.50	94.16	12.92
37.Deepavas	5.89	17.58	26.26	7.50	94.13	16.07
38.Dayalana Kala	3.15	18.89	59.65	12.50	100.75	17.03
39.Meenapara	4.43	68.26	3.43	10.00	83.33	13.22
40.Gurali	4.53	84.29	0.00	7.50	83.65	0.52
41.Nathusar(Sikar)	8.21	14.58	2.89	25.00	96.09	16.24
42.Mehroli	4.25	10.78	9.07	32.50	94.16	23.65
43.Manora	4.99	28.50	54.79	17.50	114.43	11.21
44.Palri	4.82	29.90	85.37	27.50	107.66	19.03
45.Sohla	7.49	33.23	6.42	25.00	90.20	11.02
46.Amli	4.27	28.09	2.32	10.00	86.02	22.27
47.Sare	1.23	54.36	9.76	5.00	98.12	8.00
48.Peepli 'A'	1.52	96.16	0.00	7.50	101.81	5.97

X_5 = Sex-Ratio (female population per 100 male population)

X_6 = Literacy Rate (literate population as % of total population)

X_7 = Area under Non Food Crops as percentage of total sown area.

X_8 = Gross irrigated area as % of gross sown area

X_9 = Cropping Intensity

Y = Average Annual Daily Agricultural Wage Rate for Adult male casual labour (Rs./day).

Coefficients of correlation are worked out between dependent variable (Y) and each of the independent variables based on 1970-71 data for 48 observations (villages).

TABLE 5.2

Independent Variable	Correlation Coefficient with (Y)	
X_1	+0.4419 *	(Expected sign)
X_2	-0.2910 ***	(Expected sign)
X_3	-0.1347	(Expected sign)
X_4	+0.1405	(Expected sign)
X_5	-0.3463 **	(Expected sign)
X_6	+0.0282	(Expected sign)
X_7	-0.3929 *	(Unexpected sign)
X_8	-0.3266 ***	(Unexpected sign)
X_9	-0.4813 *	(Unexpected sign)

* Significant at 1 percent level of confidence with 45 d.f.

** Significant at 2 percent level of confidence with 45 d.f.

*** Significant at 5 percent level of confidence with 45 d.f.

Correlation coefficient between X_1 (Land-man ratio) and Y (Wage) is highly significant at 1% and bears expected sign. This implies villages with high land-man ratio had higher wages than those of low land-man ratio. It means higher population pressure depresses wages.

Significant negative value of r between X_2 (S/C and S/T population) and Y (wage rate) stresses upon the role that the former plays in depressing wage level.

Agricultural labourer (X_3) shows expected insignificant relationship. This implies higher ratio of labourers to agricultural workers depresses wage rate due to excess supply of labour against their demand.

The reason why the correlation coefficient is insignificant perhaps, is improper definitional concepts adopted in 1971 Census for the enumeration of working population. Most of the female labourers, who hire out their labour and augment labour supply, had not been enumerated as labourers. It caused under-estimation. This reduced proportion of agricultural labourers to agricultural workers. That is why, perhaps, correlation coefficient has turned out to be insignificant.

Low correlation coefficient with positive sign between location-communication scores (X_4) and wage rate (Y) signifies that villages favourably placed in terms of these facilities had higher wages comparatively. Our results are in conformity with other studies.[9] But this did not show significant impact on wages. We have earlier mentioned that numerous such factors affect wage rate, while we have assessed the impact of only four such factors.

Sex-ratio (X_5) yielded expected and significant results, signifying that high proportion of females to males depressed wage rates to a considerable extent. This highlights how sex-ratio substantially affects wage rates in villages, and how the constitutional provision of 'Equal pay for equal work' holds true in real life.

Literacy rate (X_6) had shown positive and expected influence on wage level; yet almost negligible (+0.0282). Coefficients of correlation between wage rate (Y) and each of the independent variables, X_7 (Non Food Crops), X_8 (irrigation) and X_9 (cropping Intensity), are highly significant but with unexpected signs.

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9. (i) Bardhan, K., Op.Cit., June 1973
(ii) Srivastava, G.C., Op.Cit.,
(iii) Suresh Chandra, Op.Cit.,
(iv) Desai, M.N., Op.Cit.

Some plausible explanation of negative correlation would be:

i) Creation of additional demand for labour by irrigation, cropping intensity and area under non-food crops, depends on the degree of mechanisation also to a larger extent. Higher the degree of mechanisation, lower would be the demand generated.

ii) A shift in the tendency of hiring casual labour to attached or permanent labour due to rise in demand and availability of work round the year, may also cause a set back to wage rates. A rise in demand due to rise in cropping intensity and irrigation may not create additional demand to be met by the hired labour. Attached labour would do the additional work generated.

iii) Increased demand for labour in one area may cause an influx of immigrant labour from other areas and this may depress wages rather than increasing it. This possibility hasbeen supported by some of the empirical studies.[10] These moving families would naturally be prepared to work even at a lower than the prevailing normal wage rate.

10.(i) Jayaraman, T.K., "Seasonal Migration of Tribal labour: An Irrigation Project in Gujarat", Economic and Political Weekly, Oct.13, 1979. P.1727

(ii) Acharya, S.S., & others, "Problems and Prospects for Small and Marginal Farmers and Agricultural Labourers in Rajasthan", A Survey Report, 1978, Udaipur Uni., PP.12-13.

Some of the above reasonings had also been observed and expressed by Wold Ladejinsky[11] during his "Bihar Trip". Now we try to examine how far such circumstance existed during 1970-71 in Rajasthan.

Correlation coefficients worked out between wage and gross irrigated area and Non Food Crops area seperately for the year 1977-78 are presented below:

Year	Independent variable	Dependent variable	Coefficient of Correlation
1977-78	Gross irrigated Area (X_8)	Wage rate (Y)	+ 0.0511
1977-78	Area under Non Food Crops (X_7)	Wage rate (Y)	- 0.0889

Negative value of correlation coefficient between Non Food Crops and wage rate has declined from -0.3929 in 1970-71 to -0.0889 in 1977-78; while it turned out to be positive (+0.0511) between wage rate and irrigation for the corresponding year. It suggests wage and irrigation were positively associated in 1977-78. Non Food Crops did not depress wage rates severaly. This implies regional imbalance in the distribution of irrigation would have declined in 1977-78 as compared to 1970-71. Lorenz Curve prepared for 1970-71 and 1977-78 also proves that inequality in the distribution of gross-irrigated area among the villages had declined in 77-78 over 1970-71 (see graph V.1).

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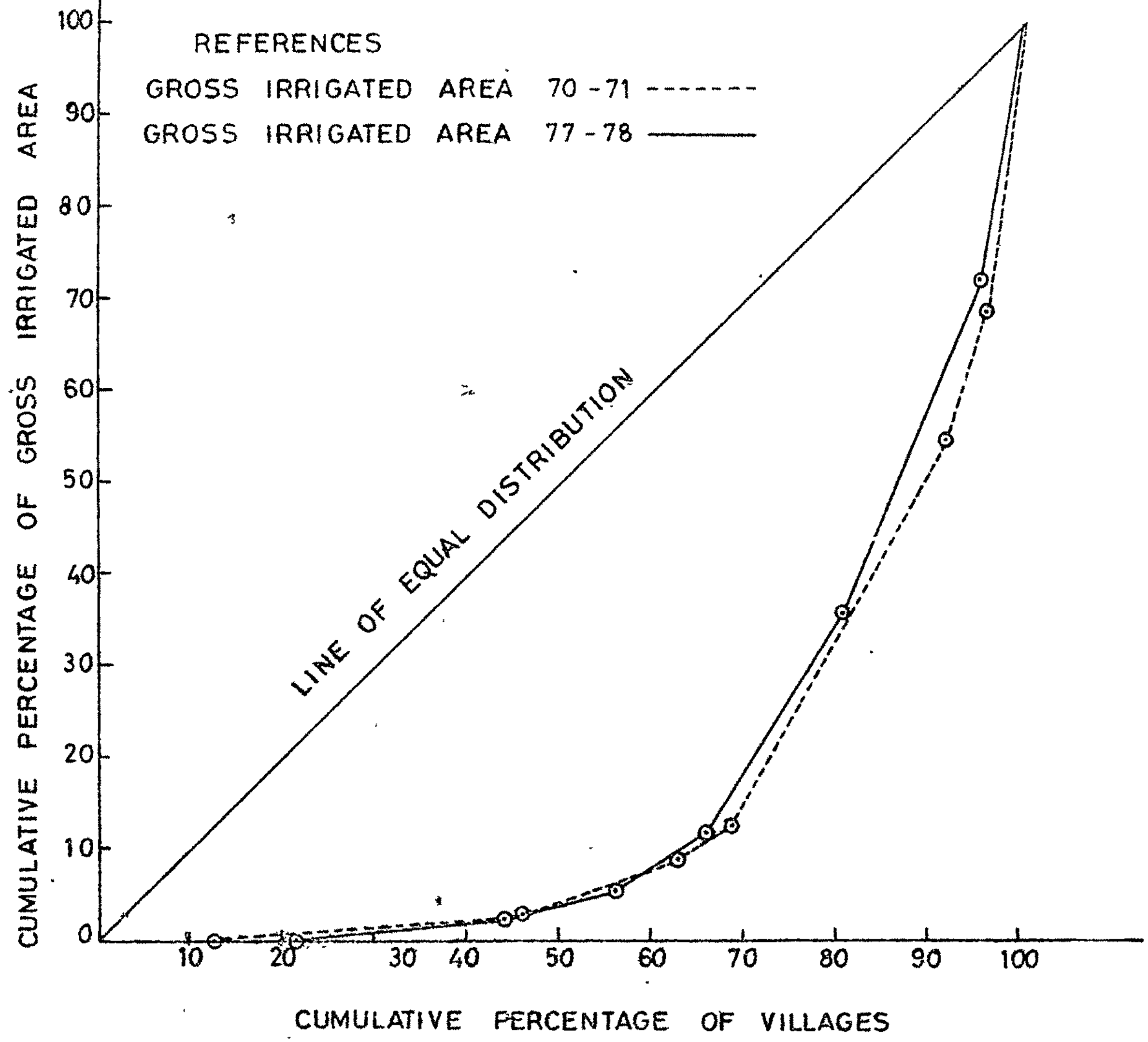
11. "Agrarian Reform as Unfinished Business", selected papers of Wold Ladejinsky, edited by Louis J. Walinsky. Chapter "Bihar Field Trip".

GRAPH V·1

LORENZ CURVE SHOWING INEQUALITY IN THE DISTRIBUTION OF GROSS IRRIGATED AREA.



Due to two crops in a year and more diversified crops in highly irrigated regions, demand for labour spreads equally over all the 12 months, instead of getting concentrated over a single month or season, say, harvesting month. As such wages may not shift upward in response to increased irrigation facilities. Contrary to it, wages shift upward in non-irrigated and single crop villages due to heavy pressure of demand in certain months. Wage data reported in "Agricultural Wages in India", are as Dr. V.M. Rao has opined, generally peak season wage rates. Therefore, wage data for low or unirrigated villages as reported are higher as compared to those of highly irrigated villages. Due to this discrepancy, correlation coefficient between wage rate and irrigation/cropping intensity would have turned out to be negative.

To examine the existence of severe regional imbalance in agricultural development, we resort to frequency distribution technique.

Table 5.3 brings out the fact that land-man ratio for 26 out of 48 villages was in between 0.01 to 5.00 acres; while for another seven villages, it was inbetween 10.01 to 20 acres, i.e., about four times more as compared to the former villages. It indicates towards very low level of agricultural activities existing in the former villages. An increase in demand in the villages of high land-man ratio, may have negative impact on wage rates due to the possibility of heavy influx of labourers

TABLE 5.3

Frequencies of Villages in Different Ranges of Land-man Ratio, Cropping Intensity, Gross-irrigated area and Non Food Crops in 1970-71

Land-man Ratio (in acres)	Village Frequency	Cropping Intensity (in percentage)	Village Frequency
0.00	NIL	0.00	11
0.01 to 5.00	26	0.01 to 5.00	9
5.01 to 10.00	15	5.01 to 10.00	9
10.01 to 20.00	7	10.01 to 20.00	8
20.01 to 40.00	NIL	20.01 to 40.00	8
Above 40.01	NIL	Above 40.01	3
Total	48	Total	48

Gross irrigated area as % of Total Sown Area	Village Frequency	Area under Non Food Crops as % of Total Sown Area	Village Frequency
0.00	6	0.00	4
0.01 to 5.00	11	0.01 to 5.00	11
5.01 to 10.00	3	5.01 to 10.00	6
10.01 to 20.00	7	10.01 to 20.00	12
20.01 to 40.00	12	20.01 to 40.00	14
Above 40.01	9	Above 40.01	1
Total	48	Total	48

Source : Table 5.1

Note :(1) Land-man ratio refers to gross sown area available per agricultural worker (2) Cropping Intensity refers to gross sown area as percentage of net sown area.

from the neighbouring 26 villages of low agricultural activities. Migrated labourers would be ready to work even at lower than the prevailing wage rate. Even then, they would find themselves in a far better position as compared to that of their own villages, where there was no work at any rate. This possibility seems to be supported in a study by Mrs. Bhalla[16] when she says, "The rapid growth of farm output tended to push up real wages; the growth of labour force at rates far above the rate of growth of population tended to pull real wages down". Labour growth rate to be higher than that of population growth implies influx of labour from neighbouring States/districts. So long as additional demand for labour in 26 villages of the lowest land-man ratio is not generated, an increase in demand for labour in the villages of high land-man ratio would prove to be a small drop in the ocean.

Frequency tables for cropping intensity, irrigation and non-food crops area (see table 5.3), reveal more severe imbalance and surprising facts. On one hand, 11, 6 and 4 villages (21 villages) had neither cropping intensily nor irrigation, nor area under non-food crops respectively. As a result demand for hired labour would have been almost zero in these villages. On the other hand, 3,9 and 1 villages (13 villages) had more than 40% of cropping intensity, gross irrigated area and non-food crops

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16. Bhalla, Sheila; Op.cit.

area respectively. That is to say, these villages were better in agricultural activities.

This shows how severe imbalance existed among the villages from agricultural activities point of view. Villages having excess work force (21 villages) out number those having extra demand (13 villages) to hire labour force. Therefore, perhaps, wage rate would have negatively responded to demand creating factors like irrigation, cropping intensity and non-food crops.

5.2.2. Analysis of Correlation Matrix

Before we fit a multiple regression model, it is proper to construct correlation matrix to detect the cases of multi-collinearity among independent variables. This helps in ascertaining precise explanatory power of each of the independent variables. Another objective behind its construction is to eliminate some of the less significant independent variables. This reduces number of total explanatory variables by dropping insignificant variables.

Correlation matrix for all the ten variables is presented in table 5.4.

TABLE 5.4

CORRELATION MATRIX

	X_1	X_2	X_3	X_4	X_5	X_6
X_1 = Land-man Ratio	-					
X_2 = S/C and S/T population as % of total population	-0.2789	-				
X_3 = Agricultural labourers as % of agricultural workers	-0.1652	-0.1594	-			
X_4 = Location and Communication Scores	+0.1073	-0.2806	+0.0671	-		
X_5 = Sex-Ratio i.e. Female population per 100 male population	-0.3473	+0.0542	+0.3980	+0.0294	-	
X_6 = Rate of literacy (Literate population as % of total population)	+0.0585	-0.3509	+0.2078	+0.6298	+0.0466	-
X_7 = Area under Non-food crops (N.F.Cr.) as % of total sown area	-0.3546	-0.0847	+0.3033	-0.1377	-0.0133	+0.0628
X_8 = Gross irrigated as % of gross sown area	-0.3796	-0.01043	+0.2670	+0.2418	-0.0307	+0.1165
X_9 = Cropping Intensity $\left\{\frac{\text{Gross sown area x 100}}{\text{Net sown area}}\right\}$	-0.4526	+0.1147	+0.0843	+0.1101	+0.1764	+0.1395
Y = Daily agricultural wage rate (Rs.)	+0.4419	-0.2910	-0.1347	+0.1405	-0.3463	+0.0282

Correlation Matrix reveals that X_1 (Land-man Ratio) is significantly associated not only with the wage rate, but with sex-ratio, Non-food crops, irrigation and cropping intensity (X_5, X_7, X_8 and X_9 respectively) also. This means land-man Ratio (X_1) alone can reflect impacts of sex-ratio, Non-food crops, cropping intensity and irrigation on wage rate (Y). Further, X_7, X_8 and X_9 (Non-Food Crops, irrigation and cropping Intensity) variables are although, significantly correlated with Y, but with unexpected negative sign. Therefore, we may drop X_7, X_8 and X_9 for purposes of regression analysis. Sex-ratio (X_5) is significantly correlated with Y with expected sign. It is correlated with X_1 also with the same level of significance. It implies we should select either X_1 or X_5, but not both. Of the two, X_1 (land-man ratio) is more significantly associated with Y. This indicates towards the higher explanatory power of X_1 than X_5. As such, we retain X_1 and drop X_5. Further, X_5 is significantly associated with X_3 (agricultural labourers) also; while X_3 is not related with X_1.

X_7 (area under Non-Food crops) has shown significant relationship with X_3 (agricultural labourers). If we retain X_3, it will reflect influence on Y not only of X_5 (sex-ratio) but of X_7 (Non-food crops) also. Thus, the influence of X_5 (sex-ratio) on Y (wage rate) will be exhibited not only by X_1 (Land-man ratio), but by X_3 (Agri.labourers) also. In case we drop X_1 and retain X_5, impact of X_1 (land-man ratio) will be reflected only by X_5 (sex-ratio) alone. Further, X_5 does not reflect impacts of X_7, X_8 and X_9 (Non-Food Crops, irrigation and cropping intensity) independent variables. But in reverse position i.e., if X_1 (land-man ratio) is retained and X_5 is dropped, impact of X_5 (sex-ratio) will be explained by two variables i.e., X_1 and X_3 (Agri.labour). Moreover, X_1 will reflect influence of variables X_7, X_8 and X_9 (Non-food crops, irrigation and cropping intensity respectively) also. Here again the inclusion of X_1 over X_5 (sex-ratio) seems strongly justified.

Similar logic is applied to X_3 and X_5 (agricultural labourer and sex-ratio). If we include X_3 and exclude X_5, impact of X_5 on Y (wage rate) will be displayed not only by X_3, but by X_1 (land-man ratio) also. But in opposite situation, impact of X_3 (agricultural labourer) will be explained by only X_5 (sex-ratio) and not by X_1. That will be injustice towards X_3. Therefore, it is sufficiently justified to retain X_1 (land-man ratio) over X_5, and X_3 (agricultural labourers) over X_5 (sex-ratio).

X_2 (S/C and S/T population) and Y (Wage rate) are correlated significantly with negative sign as hypothesised. X_2 is not associated significantly with any other independent variable except X_6 (Literacy rate). But X_6 is insignificantly related with Y (wage rate). Therefore, of the two, X_2 and X_6, inclusion of X_2 is important and justified.

Now the remaining independent variable is X_4 (location-communication scores). X_4 shows significant relationship with X_6 (literacy rate) and, that too with expected sign. The former has shown more influence on wage rate than the latter. Therefore, we include X_4 (Location communication scores) and exclude X_6 from the regression model. Moreover, the influence of X_6 is explained by X_2 (S/C and S/T population) also; while, that of X_4 on Y is not shown by any other independent variables already selected for regression. Though X_4 (location-communication scores) is inter-related with X_2, but not significant even at 5% level of confidence.

But still there remains the problem of choosing between X_3 (agricultural labourers) and X_5 (sex-ratio). Therefore, re-evaluation of these two variables will not be out of place, based on the following reasonings:

(a) It is X_5 (sex-ratio) not X_3 (Agri-labourers) which is significantly correlated with Y - the dependent variable.

(b) X_5 (sex-ratio) is highly inter-related with X_1 (land-man ratio); while, X_3 (agricultural labourer) is not associated with any other independent factor. This shows supremacy of X_3 over X_5 and provides grounds for former's retention. But, if we select X_3 and drop X_5, we will be ignoring a variable explaining variations in Y in a significant manner.

As our prime objective is to find out important variables which may explain variations in wage rate (Y) in a better way; this warrants selection of those factors, which have high explanatory powers individually.

(c) Though X_5 (sex-ratio) is highly inter-correlated with X_1 (land-man ratio), and inclusion of latter will reflect former's impact on explained variable (wage rate) in a joint way; but X_1 fails to reflect individual explanatory power of X_5. To ascertain explanatory power of X_5, it seems essential to run a regression including this variable also.

In case, we select one of the two variables (X_3 and X_5), we have to loose other variable's individual influence on Y. Therefore, it will not be undesirable to run two regression equations separately. The first one will be based on X_1 (land-man ratio) X_2(S/C and S/T population), X_3 (agricultural labourers) and X_4 (location-communication scores) independent variables excluding X_5 (sex ratio). While, second one will include X_5 replacing X_3 (agricultural labourers).

5.2.3 Multiple Linear Regression Analysis

In order to measure the effect of selected explanatory variables on explained variable (wage rate); and to examine what factors explain wage variations most among villages, a Multiple linear Regression Model is fitted to the inter-village cross-section data at 1970-71 point of time in the following order:

MODEL 'A'

$$Y = a + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4$$

Where,

Y stands for dependent variable - average annual daily agricultural wage rate (Rs.);

a is constant and Bs are coefficients,

X_1 to X_4 represent independent variables included in the model to determine level of Y;

X_1 stands for land-man ratio;

X_2 denotes S/C and S/T population;

X_3 represents agricultural labourers; and,

X_4 stands for location-communication scores.

After running regression equation, we get results as under:

Results : $Y = 2.657243 + 0.074013\ X_1 - 0.005911\ X_2 - 0.004498\ X_3 + 0.004802\ X_4$

t values are $t_1 = 2.565871$ *

$t_2 = -1.303872$ ***

$t_3 = -0.785783$

$t_4 = 0.396774$

$R^2 = 0.239120$; $\bar{R}^2 = 0.168340$; F-ratio = 3.378383**

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* significant at 1% level of confidence with 40 d.f.,

** significant at 5% level of confidence with 5 and 40 d.f.,

*** significant at 10% level of confidence with 40 d.f.

All the B_i (regression co-efficients) bear expected signs, though all do not have significant values. X_1 (land-man ratio) emerges as the most significant explanatory variable exerting the highest influence on the level of wage rate in agriculture. It explains variations in wages at village level most as only its regression co-efficient (B_1) is statistically significant at 1% level of confidence. This implies wages were low due to low land-man ratio and high population pressure on land.

X_2 (S/C and S/T population) is next important to X_1 having regression coefficient (B_2) significant at 10% level. Other coefficients are, though statistically not significant, but not negligible also. They do affect the level of wage rate. Agricultural wage rate is found to be positively responsive to X_4 (location-communication scores) though not significant. But the underlying implication is that it may emerge as a power-full factor affecting the level of wage rate in the years to come, as the process of industrialization and urbanisation in the country and that of marketization and mechanisation in agriculture, accelerates. X_3 (agricultural labourer) depresses wage rate as per the visualised hypothesis. Higher the labour supply, lower the wage rate is a universally accepted hypothesis.

All the four independent factors taken together explain 24% (R^2= 0.239120) of the total variation in wage rate. Though value of R^2 is low, yet its significance cannot be denied and under-rated since F-ratio is statistically significant at 5%

level of significance.

Model 'B'

As mentioned earlier, sex-ratio is equally important and has solid grounds for its inclusion in the model in place of agricultural alabourers. Model 'B' is fitted accordingly;

$$Y = a + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4$$

Where,

Y, Bs and X_s except X_3 are the same as mentioned in model 'A'. Here X_3 stands for sex-ratio.

Results of the model 'B'

$$Y = 4.472147 + 0.061943X_1 - 0.005407\ X_2 - 0.019763X_3 + 0.005718X_4$$

t values are $t_1 = 2.115734$, **

$t_2 = -1.247555$,

$t_3 = -1.676811$, ***

and, $t_4 = 0.483518$,

$R^2 = 0.275564$; $\bar{R}^2 = 0.208174$; F-ratio = 4.089133*

Durbin - Watson 'd' statistic = 1.695*

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* F-ratio is significant at 1% level of confidence with 4,40 d.f., d-statistic is significant at 1% level of confidence

** t-value is significant at 2.5% level of confidence with 40 d.f.

*** t-value is significant at 10% level of confidence with 40 d.f.

Here, too, all the B_s have expected signs. X_1 again emerges as an important independent variable. X_3 (sex-ratio), in Model 'B', seems to be a better explanatory variable than agricultural Labourer in Model 'A', since its t-value is statistically significant at 10% level of significance. Perhaps, owing to this only, value of R^2 has moved upward from 0.2391 to 0.2755. This also shows greater significance of sex-ratio over agricultural labourers in wage determination. Further, F-ratio has also higher significant value (significant at 1% level) than that of model 'A' (signi. at 5% level only).

Durbin-Watson 'd' statistic is also significant at 1% level; since observed value ('d'=1.695) is > table value (du = 1.53) with 4 explanatory variables and 45 observations. Error or disturbance terms are not serially correlated. That is, the effect of disturbance term occurring at one point of time was not carried over to another point of time. As ours is a cross-section model, the non-existance of autocorrelation suggests that error term affecting agricultural wage rate in one of the villages was not going to affect wage rates of other villages. The non-existance of auto-correlation suggests that the statistical model 'B' which we have fitted, is not mis-specified. Whatever explanatory variables, we have chosen, are important and no other important variable seems to be left out of the model.

Model 'C'

Log-linear technique is supposed to be better one, as its B_s are elasticity coefficients to explanatory variables (X_s).

With B_s as elasticity coefficients, one can directly measure the variation in explained variable with respect to variations in explanatory variables. Further, this will serve as a counter-check to the regression results derived earlier by simple linear models and the validity of explanatory variables will also be confirmed.

We use the following function.

$$Y = a\ X_1^{B_1}\ X_2^{B_2}\ X_3^{B_3}\ X_4^{B_4}$$

After converting it into log linear form, the equation is as under:

$$\text{Log } Y = \text{Log } a + B_1 \log X_1 + B_2 \log X_2 + B_3 \log X_3 + B_4 \log X_4$$

Where,

Y is explained variable - the wage rate in agriculture,

a is constant;

X_1 to X_4 are explanatory variables as mentioned in model 'B'.

B_1 to B_4 are elasticity coefficients of X_1 to X_4 variables respectively.

After running regression equation, we get the results mentioned below:

<u>Results</u>

$$\text{Log } Y = \log 4.112744 + 0.097732 \log X_1 - 0.0785809 \log X_2 - 0.680162 \log X_3 + 0.041846 \log X_4$$

t values are $t_1 = 1.646854$ *** $t_2 = -1.521649$ ***

$t_3 = -1.847249$ ** $t_4 = +0.776947$

$R^2 = 0.28089$; $\bar{R}^2 = 0.213996$; F-ratio = 4.199043*

Durbin - Watson 'd' statistic = 1.721*

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* F-ratio is significant at 1% level of confidence with 4, 40 d.f.
'd' Statistic is significant at 1% level of confidence with 40d.f.
** Significant at 5% level of confidence with 40 d.f.
***Significant at 10% level of confidence with 40 d.f.

Value of R^2 has slightly improved. X_3 (sex-ratio) dominates all other independent variables in deciding level of wage rate. Its coefficient is significant at 5% level of confidence. It suggests that elasticity of agricultural wage rate with respect to changes in sex-ratio (X_3) is -0.68. That is, a 1% increase in X_3 (sex-ratio) keeping other variables constant, pulls down agricultural wages by 0.68%. X_2, earlier insignificant, has also picked up its position. Thus X_2 and X_3 show improvement, and X_1 shows decrease in its significance level. Thus, depressed classes and females pull down wages in agriculture to a considerable extent. Caste and sex elements play a crucial role in deciding wage level and in explaining wage variations.

'd' statistic being > du implies that there exists no autocorrelation.

5.2.4 Regression Analysis and Verification of Hypotheses at District Level

To explore how far the factors significant at village level, are also significant and crucial at district level in the determination of level of wage rate, we resort to multiple regression analysis. Since land productivity data are available at district level, we include it as a variable in the model, though it was not included at village level due to lack of data. Location-communication scores evolved at village level, will not be relevant for district level analysis in its original form, hence we drop it. Other factors included, are land-man ratio, sex-ratio and scheduled caste and scheduled tribes population.

With the inclusion of above four independent variables, regression model is fitted as under:

$$Y = a + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4$$

Where, Y stands for annual wage rate (Rs./day).

a is constant. Bs are coefficients of explanatory variables.

X_1 denotes land productivity per hectare measured in terms of value of output of 19 major crops computed at 1970-71 Farm Harvest Prices.

X_2, X_3 and X_4 are land-man ratio, sex-ratio and S/C and S/T population, and are worked out based on earlier concepts.

Results : $Y = 9.4504375 + 0.0002929\, X_1 + 0.241592\, X_2$
$-0.0821519\, X_3 + 0.0005709$

$t_1 = 0.609733; \quad t_2 = 2.531166^*$

$t_3 = -2.57960^*; \quad t_4 = 0.054689$

$R^2 = 0.49806$, F-ratio = 5.20944*

X_2 (land-man ratio) and X_3 (sex-ratio) exert significant influence on the level of wages in agriculture at district level; since their t-values (coefficients) are highly significant. It seems, these two variables would have determined level of geographical wage variations to a larger extent. In other words, wages differred from district to district substantially due to variations in these two factors. These two variables were highly significant in wage determination at village level also. X_1 (land productivity) has insignificant t-value. S/C and S/T population shows positive effect on wage level, which is contrary to our hypothesis. S/C and S/T population had exhibited significant and negative impact on the level of wages at village level; but at district level, its influence is quite low and positive also. Why has this happened ? Proportion of low caste population was substantially high in many villages; as such its impact would have been significant

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* t values are significant at 1% level of confidence with 21 d.f.

* F-ratio is significant at 1% level of confidence with 4, 21 d.f.

on wage rate. But a district, consisting of thousands of villages, will not have proportion of S/C population considerably high. Perhaps, due to this, S/C population might have not shown significant impact on wages at district level.

The fitted model explains about 50% of the total geographical wage variation in agricultural wages at district level.

The model exposes a very important fact about agricultural wages. Insignificant influence of land productivity on wage level seems striking. It implicitly points to the greater significance of quantity rather than the quality of land.

The foregoing regression analysis throws light on an important question also. Whether geographical wage variations arise due to variations in factor productivity; or, due to variations in labour force composition; or due to the variations in both ?

The regression model, fitted for district level analysis, includes four explanatory variables. X_1 (land productivity) and X_2 (land-man ratio) represent variations in factor productivity, while, X_3 (sex-ratio) and X_4 (S/C and S/T population) represent variations in labour force composition.

The results show that X_2 (land-man ratio) and X_3 (sex-ratio) are equally important and significant in explaining wage differentials. Similarly X_1 (land-productivity) and

X_4 (S/C and S/T population) are insignificant. It seems, geographical wage differentials in agriculture are, by and large, equally based on variations in factor productivity and also on variations in labour force composition.

5.3 Conclusion

Six of the nine selected independent variables showed relationships with wage rate as per the established hypothesis. Coefficient of correlation between land-man ratio and agricultural wage rate turned out to be highly significant. Land-man Ratio affected wages in positive direction substantially. Sex-ratio and S/C and S/T population also showed - significant inverse relationship with wage rate. It seems, presence of these two factors would have depressed wage level to a considerable extent.

Location- communication facilities showed though positive but insignificant relationship with agricultural wage rates. It exerts moderate positive impact on wages. Similarly, agricultural labourer, the supply factor, also showed expected negative association with agricultural wage rate but insignificant. The reason would have been, perhaps, improper definitional concept adopted in 1971 census for the enumeration of working population.

Cropping Intensity, % irrigated area and % area under non food crops, the demand affecting variables, showed significant correlation with the wage rate but negative and unexpected. The unexpected inverse relationships of these three factors with the wage rate, seems due to a host of adverse factors, such as negligible increase in irrigated area or in non foods crops area, large number of very small size of operational holdings bigger size of cultivator's family and heavy influx of casual labourers from neighbouring villages etc.

After detecting cases of multicollinearity with the help of correlation matrix, four independent variables (land-man ratio, S/C and S/T population, agricultural labourers and location-communication facilities) are chosen for regression analysis.

Regression model 'A' based on the above mentioned variables explained 24% of the total spatial wage variations in agriculture. F ratio is significant at 5% level of confidence implying that the variables included in the fitted model are important. Of the four independent explanatory variables, land-man ratio explained wage variations most and affected wage level in positive direction substantially. S/C and S/T population showed significant depressing impact on wage rate. Agricultural labourers and location-communication facilities exerted influence on wage rates as per the established hypothesis but insignificantly

Regression model 'B' was also fitted after replacing agricultural labourers by sex-ratio. Other three factors remained unchanged. The significance level of land-man ratio in affecting wage level declined when incorporated with sex-ratio. Similarly, S/C and S/T population also did not depress wages significantly. Thus perceptible changes took place in the levels of significance of various explanatory variables. The model explained 28% of the total wage variation. F-ratio was found to be significant at 1% level of confidence.

Durbin-Watson 'd' statistic is found to be significant at 1% level of confidence suggesting that there did not exist auto-correlation.

The regression model 'c' fitted in log-linear form improved the value of R^2 negligibly. But significance level of various independent factors changed considerably. Sex-ratio dominated all other factors in determining the level of wages. Elasticity of agricultural wage rate with respect to the changes in sex-ratio is -0.68. Thus sex ratio, it seems, depresses the wage level most. Coefficients of land-man ratio and S/C and S/T population are significant but not very high.

The analysis does indicate that the factors affecting the level of agricultural wage rate and explaining wage variations at village level and also at district levels, had been, by and large, homogeneous. Land-man ratio and sex-ratio explained wage differentials most among the villages and also among the districts. S/C and S/T population showed higher depressing effect on wage rates at village level as compared to the district level.

Low impact of land productivity on agricultural wages as compared to that of land-man ratio, emphesise the fact that volume of work rather than the value of product decided wage rates most.

The analysis further shows that geographical wage differentials in agriculture are, by and large, equally based on variations in factor productivity and also on variations in labour force composition.