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Vol XXIX
No. 3

ISSN 0019-5014

CONFERENCE
NUMBER

JULY-
SEPTEMBER
1974

INDIAN JOURNAL OF AGRICULTURAL ECONOMICS



INDIAN SOCIETY OF
AGRICULTURAL ECONOMICS,
BOMBAY

PRODUCTIVITY, WAGES AND ITS DETERMINATION IN GUJARAT AGRICULTURE : AN INTER-DISTRICT ANALYSIS

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The recent increases in production and productivity influencing agricultural wages have become a debated issue, for the results of empirical studies are diverse and sometimes conflicting. Studies have shown a positive relationship between real wages and production and productivity.¹ Simultaneously, it has also been observed that the real wages seem to have declined or remained stagnant in spite of increase in agricultural production.² However, a close relationship may be found between wages and productivity. But its explanation may pose problems within the framework of a labour market assuming perfect competition. Besides other imperfections, the unemployment creates problem in the proper functioning of a labour market. In a situation of below full employment, it does not stand to logic why a farmer/or an area will pay higher wages than the prevalent ones to labourers just because he/or it is having higher productivity.³ In such a case a farmer/or an area is not forced by the labour market to pay higher wages to attract labourers. Keeping this in view, we have argued in this paper that there does not appear to be reasonable basis to expect a positive relationship between wages and productivity.

So far the wage-productivity relationship and factors determining wages have been examined at the State level or combining a few States into a region. Apart from misleading State level averages, the studies based on such averages have implicitly assumed national labour market, which is indeed difficult to

*The views expressed in this paper are the personal views of the authors. Thanks are due to Dr. D. S. Tyagi for his comments on an earlier draft of the paper.

1. J. W. Gough, "Agricultural Wages in Punjab and Haryana, *Economic and Political Weekly*, Vol. VI, No. 13, March 27, 1971; R. W. Herdt and E. A. Baker, "Agricultural Wages, Production and the High-Yielding Varieties," *Economic and Political Weekly*, Vol. VII, No. 13, March 25, 1972; A. V. Jose, "Trends in Real Wage Rates of Agricultural Labourers," *Economic and Political Weekly*, Vol. IX, No. 13, March 30, 1974.

2. Pranab Bardhan, "'Green Revolution' and Agricultural Labourers," *Economic and Political Weekly*, Vol. V, Nos. 29, 30 and 31, Special Number, July, 1970; N. Krishnaji, "Wages of Agricultural Labour," *Economic and Political Weekly*, Vol. VI, No. 39, September 25, 1971.

3. T. S. Papola, "Inter-Industry Wage Structure : Technology Hypothesis," *Anvesak*, Vol. II, No. 1, June, 1972.

conceive in a vast country like India. This is more so in the agricultural sector probably due to lack of geographical mobility of labour. However, the simultaneous persistence of labour surplus as well as labour deficit areas in the country indicates that markets are more local and regional.⁴ The existence of wide geographical wage differentials in the agricultural sector also suggests that labour markets function within the local and regional boundaries. Further, the wage payment systems differ from one area to another. These factors have prompted us to study the district-wise analysis of wage-productivity relationship during 1960-61 to 1968-69 and also to identify the factors affecting inter-district wage differentials for 1968-69 in Gujarat. Specially, it attempts : (i) to study the trends in money wages, real wages and productivity, (ii) to examine the wage-productivity relationship over time, and (iii) to identify important factors determining the wage level at a point of time, 1968-69, among districts of Gujarat.⁵

HYPOTHESES

The wage rate of a labour market is determined by the forces of demand and supply. The former is a function of the marginal productivity of labour, whereas the latter is being determined by the structure and size of labour force. In this framework, the productivity comes into picture as a shift parameter presumably to an upward demand for labour. The rise in demand for labour is likely to enhance the wages. Therefore, if a farmer or a region is having higher productivity, it is expected that there would be higher wage level, provided the supply curve of labour has a positive slope. It is the nature of supply curve,⁶ which plays an important role in the behaviour of wages to respond to productivity and certain other economic changes.

4. T. S. Papola, "The Indian Labour Market," *Economic and Political Weekly*, Vol. III, No. 30, July 27, 1968.

5. The data regarding wages have been collected from the records of Directorate of Economics and Statistics, Ministry of Agriculture, Government of India. The wage rate refers to the category of 'Field Labour,' which is presumably an average for all the agricultural operations such as ploughing, sowing, weeding, harvesting, etc. The wage rate includes cash payment and the cash equivalent of perquisites received by labourers. The districts have been chosen as the basic unit of analysis. The district wage rate is estimated by taking simple average of the wage rate of twelve months for different centres in each district.

The data relating to area, production are taken from published and unpublished reports: Statistics of Area, Production and Yield per Acre of Principal Crops, Agricultural Statistics of Gujarat State and Season and Crop Reports of the Directorate of Agriculture, Gujarat. The data on the number of cultivators and cultivated area in different farm sizes for 1961 are collected from Hand Book of Basic Statistics of Gujarat State, 1963; whereas the data on the number of tractors, pump-sets for 1966 are drawn from the *Quarterly Bulletin of Economics and Statistics*, Vol. IX, No. 1, January-March, 1969, Bureau of Economics and Statistics, Government of Gujarat. The data on the number of agricultural workers have been taken from Census of India 1961, Gujarat State, Vol. V, Part II, Household Economic Tables.

The data of Bulsar district on several variables have been adjusted with Surat, as the former was part of the latter till 1962-63. Similarly, the data of Gandhinagar district have been adjusted in equal proportion to Mehsana and Ahmedabad districts.

6. In postulating *a priori* workers' response to wages is a difficult problem because wage increase produces both income effect as well as substitution effect. It means, if wages increase, leisure becomes costly (substitution effect), which may induce workers to increase their working hours. Alternatively, wage increase may result in a certain level of income (income effect), which may induce workers to reduce the working hours. Both effects are in opposite direction, due to wage rate and time constraints, unless leisure is an inferior good. However, positive sign for the combined effect

(Contd.)

Since there is large-scale unemployment, the assumption of positive slope of supply curve for labour is violated in a fundamental way. The Second Agricultural Labour Enquiry found that the agricultural workers were employed on an average for about 217 days in a year in the then Bombay State and had no employment for the rest of the year, while open unemployment was estimated at around 3.5 per cent.⁷ But it may be noted that during the busy seasons of the year all of them are employed.⁸ In this context, it may be noted that the problem of unemployment in the rural areas is mainly of surplus 'labour' and not of surplus 'workers.'⁹ It is, therefore, reasonable to assume particularly in an area of surplus labour, the supply curve of labour being perfectly elastic over a large range.

However, in a big country or region, it is not unusual to find an area of labour deficit as well, giving a positive slope to supply curve of labour. Thus, depending upon the size of labour force in the agricultural sector, we have postulated supply curves for labour, *viz.*, perfectly elastic and supply curve with a positive slope. In the former an upward shift in demand curve for labour would increase employment rather than wages, whereas in the latter it would increase both employment and wages.¹⁰

The factors such as extent of irrigation, distribution of land holdings, etc., seem to be responsible for an upward shift in the demand curve for labour, which, in turn, determines the level of wages in an area. For instance, in the case of a positive slope for supply curve of labour, if distribution of land

(Contd.)

of income and substitution effects could be postulated, indicating an upward sloping supply curve of labour rather than downward sloping supply curve.

Though, in a study it has been observed that "the proportion of labourers in the family as per the First Agricultural Labour Enquiry is the highest in Central India, wage rate is the lowest in the same region. The proportion of earners in the family is the lowest in the North-West India and the wage rates are the highest in the same region, the same type of relationship can be seen from the data of the Second Agricultural Labour Enquiry also... It appears that labour supply in rural areas is *backward sloping*" (Italics added.) See G. Parthasarathy, "Agricultural Labour in South India" in G. C. Mandal: *Proceedings of Conference*, Vol. VII, Seminar on Human Factor in the Growth of Rural Economy, Visva-Bharati, Santiniketan, 1963, p. 138.

How can a backward sloping curve be inferred from the above observation? It is rather expected that in an area where the proportion of earners in the family is the highest, the wage rates should be the lowest. What can be inferred is that in such a case, the supply curve of labour may be perfectly elastic, indicating that at the given wage rate, one can employ as many workers as one needs. On the other hand, where the proportion of earners in the family is the lowest, the wage rate should be highest, having a positive slope for the supply curve.

7. Report on the Second Agricultural Labour Enquiry, Vol. I—All India, 1956-57, Labour Bureau, Ministry of Labour and Employment, Government of India, 1960.

8. W. Ladejinsky, "The Green Revolution in Punjab: A Field Trip," *Economic and Political Weekly*, Vol. IV, No. 26, June 28, 1969.

9. V. N. Misra, "Labour Market in Agriculture: A Study of Gujarat Districts," *Indian Journal of Agricultural Economics*, Vol. XXV, No. 3, July-September, 1970.

10. R. W. Herdt, and E. A. Baker, *op. cit.*

However, in a study it has been hypothesized that a shift in the demand curve for labour within the perfectly elastic portion of the supply curve may lead to more employment rather than higher wages. What has been missed here is that merely a shift in demand curve may not lead to more employment. A shift in demand curve has to be upward. And if there is a shift in demand curve to the left, it may decrease employment. See S. M. Pandey, "Wage Determination in Indian Agriculture: An Empirical Analysis," *Indian Journal of Industrial Relations*, Vol. 9, No. 1, July, 1973.

holding is not skewed indicated by low concentration ratio,¹¹ it is rather expected that the level of wages would be high in such a case. On the other hand in the case of perfectly elastic supply curve, if the land concentration ratio is also high, the big farmers having large holdings are expected to be quite sizable in number and being the major employers of hiring agricultural labourers,¹² they would be in a position to exert monopsonistic pressures on them.¹³ This, in turn, may depress the level of wages. Similar is the case with the extent of irrigation while shifting the demand curve for labour to the right, would increase the level of wages.

To revert to the theme of wage-productivity relationship, it may be mentioned that even in organized industries in most of the States there does not appear to be a positive relationship between wages and productivity.¹⁴ However, the wages based on piece rate system are expected to show fairly tight link with the productivity, provided that changes in productivity are the result of relatively minor technological innovations that do not necessitate a re-setting of piece rates.¹⁵ Applying the same logic to agriculture, it could be argued that the wages would not be influenced by changes in productivity on the ground that a large part of increase in productivity in agriculture is probably due to the new technology based on high-yielding varieties of seeds, rather due to higher use of human labour, and the extent of piece rate system is also very limited in Gujarat agriculture.¹⁶

TRENDS IN WAGES AND ITS RELATIONSHIP WITH PRODUCTIVITY

Trends

In order to study the trends in behaviour of wages and productivity, first we have worked out their index numbers with 1960-61 as the base year. The data regarding indices of productivity for all crops have been taken from an earlier study in Gujarat,¹⁷ which covers the period 1949-50 to

11. This is based on Gini's Concentration ratio. Higher ratio indicates more inequality in the land distribution and vice versa. An area with low concentration ratio suggests that the cultivators of small size are also expected to have relatively more big holdings than those in an area with high concentration ratio (provided, of course, the total cultivated area is not very much higher in the former than in the latter).

12. It has been found that the demand for hired labour per unit of land tends to increase with the size of holdings. Cf. Studies in the Economics of Farm Management, Combined Report 1954-55 to 1956-57, Uttar Pradesh, Punjab, West Bengal, Madhya Pradesh 1958-59, Sambalpur district (Orissa) 1957-58, and Madras 1956-57.

13. Kalpana Bardhan, "Factors Affecting Wage Rates for Agricultural Labour," *Economic and Political Weekly*, Vol. VIII, No. 26, June 30, 1973.

14. T. S. Papola, "Inter-Industry Wage Structure: Technology Hypothesis," *op. cit.*

15. W. G. Bowen: *The Wage-Price Issue*, Princeton University Press, Princeton, 1960, p. 80.

16. Government of Gujarat: Report of the Minimum Wages Advisory Committee for Employment in Agriculture, Education and Labour Department, Ahmedabad, 1966, p. 68.

17. For obtaining productivity indices, first output indices of all crops have been constructed by assigning weights to different crops in proportion to their share in the total value of output in the base year. Uniform State average of harvest prices for 1960-61 has been used as weights for evaluating the output of various crops. These output indices have been divided by the area index numbers for obtaining productivity indices. See V. N. Misra: *Crop Output Growth and Acreage Response in Gujarat: An Inter-District Analysis*, Sardar Patel Institute of Economic and Social Research, Ahmedabad (manuscript).

1968-69. In the present study we have taken the productivity indices for the period 1960-61 to 1968-69, for the data of wages for the corresponding period have been found more reliable than those of the earlier period.¹⁸

However, the consumer price index numbers for agricultural labourers are not available at the district level. Therefore, for obtaining the real wages the wage rates for different districts have been deflated by the consumer price index numbers for agricultural labourers for Gujarat.¹⁹ This is a serious limitation in our study, because cost of living differs from one district to another due to differences in the availability of foodgrains and its prices.

In the next step, we have fitted the exponential function²⁰ to the indices of money wages, real wages and productivity to arrive at the percentage growth rate. The results are given in Table I.

TABLE I—WAGE LEVEL AND COMPOUND GROWTH RATE OF MONEY WAGES, REAL WAGES AND PRODUCTIVITY IN GUJARAT DISTRICTS: 1960-61 to 1968-69

District	Wage rate (Rs.)		Compound growth rate (per cent)		
	1960-61	1968-69	Money wages	Real wages	Productivity
1. Jamnagar	2.46	3.49	3.13	-2.17	2.97
2. Rajkot	2.07	3.24	6.36	-0.99	3.45
3. Surendranagar	1.93	2.53	4.29	-2.96	2.42
4. Junagadh	2.33	3.60	5.35	-1.94	2.95
5. Bhavnagar	1.97	2.47	4.57	-2.71	2.98
6. Kutch	1.96	3.09	5.86	-1.50	3.37
7. Amreli	2.10	3.00	4.24	-2.99	2.95
8. Banaskantha	1.51	2.25	5.71	-1.61	0.90
9. Mehsana	1.67	2.69	5.58	-1.75	1.68
10. Sabarkantha	1.50	2.07	3.70	-1.52	-3.24
11. Ahmedabad	1.58	3.00	8.39	0.87	0.94
12. Kaira	1.53	2.34	5.61	-1.71	1.54
13. Panchmahals	0.96	1.58	6.50	-0.86	-5.27
14. Baroda	1.14	1.89	5.66	-1.64	1.42
15. Broach	1.03	1.89	6.21	-1.11	0.46
16. Surat	1.07	1.88	7.72	0.30	-0.56
Gujarat	1.67	2.48	5.28	-2.03	1.37

18. I. Hirway, "Trend in Agricultural Wages in Gujarat," *Indian Journal of Agricultural Economics*, Vol. XXVIII, No. 3, July-September, 1973.

19. Indian Labour Statistics for 1968-69 and 1972, Labour Bureau, Department of Labour and Employment, Ministry of Labour, Government of India.

20. The exponential function generally gives a good fit for trends in a time-series. It has the following form.

$$Y_t = AB^t$$

$$\text{or } Y_t = A(i+r)^t$$

$$\text{Where } B = i + r$$

Now compound growth rate $r = B - 1$

$$\text{Log } Y = \text{Log } A + t \text{Log } B$$

Now regress log Y on t by O.L.S.E. method

So compound growth rate in percentage = (Anti-log (Log B) - 1) × 100

The productivity increased at the rate of 1 to 3 per cent over the period in most of the districts. Only in Sabarkantha, Panchmahals and Surat, there was a decline in the productivity to the extent of about 3.25, 5.27 and 0.56 per cent per annum respectively.

The growth in money wages was about 4 per cent per annum in Surendranagar, Amreli and Sabarkantha. In the remaining districts, compound annual growth rates vary from about 5 to 8 per cent. Whereas, in real terms the wages declined at the rate of 1 to 3 per cent in all the districts except Ahmedabad and Surat, where it increased at the rate of about 0.87 and 0.30 per cent per annum respectively.

However, the rate of increase in money wages was faster in the districts such as Ahmedabad, Panchmahals, Broach and Surat, where the level of money wages was relatively low. But in the case of real wages, the decline was more sharp in Jamnagar, Surendranagar, Junagadh, Bhavnagar and Amreli, having relatively high level of money wages.²¹ This type of pattern is on the expected lines for the reason that the growth rate apart from other factors, becomes the function of initial level itself. It means that where the level is high, the growth rate is expected to be low.²²

Wage-Productivity Relationship

In view of the serial correlation between productivity and real wages in the twelve districts out of sixteen, it is difficult to draw any definite conclusion. Nevertheless, the non-significant coefficients of productivity in all the districts and very low explanatory power of model indicate that the changes in productivity have not at all influenced the real wages (Table II).

In the case of money wages, the regression analysis does not show serial correlation in most of the districts. The coefficients of productivity again turn out to be non-significant in all the districts except for Jamnagar, Bhavnagar, Amreli and Baroda. In these districts except Baroda the significant impact of changes in productivity on money wages may be explained by the fact that groundnut has been the main crop for which the harvesting is based on piece rate wages. Whereas in the case of Baroda, cotton is the predominant crop, and the wages for its first picking are paid according to the piece rate system. It may, therefore, be inferred that where the piece rate system of wage payment is prevalent particularly for the main crop, the money wages may get influenced by the changes in productivity. A word of

21. A similar type of observation has also been found by Krishnaji. His study is based on data at State level. It has been concluded that if this process of inter-regional convergence continues, the wage rate will settle at a uniformly low rate all over the country. This assumes national labour market, which is indeed difficult to conceive in a vast country like ours. This is all the more difficult in the agricultural sector, as mentioned earlier. See, N. Krishnaji, *op. cit.*

22. V. Nowshirvani, "The Regional and Cropwise Pattern of the Growth of Per Acre Output in India," *Bulletin of Oxford University Institute of Economics and Statistics*, Vol. 32, No. 1, 1970.

TABLE II—WAGE-PRODUCTIVITY RELATIONSHIP IN GUJARAT DISTRICTS (REGRESSION COEFFICIENTS, STANDARD ERRORS, R^2 AND DURBIN-WATSON TEST

District	Money wages				Real wages			
	Constant (a)	Regression coefficient	R^2	Durbin-Watson test	Constant (a)	Regression coefficient	R^2	Durbin-Watson test
1. Jamnagar	3.3089	0.2985* (0.1476)	0.37	0.49a	4.0916	0.0866 (0.1067)	0.09	0.78b
2. Rajkot	3.0597	0.3849 (0.2685)	0.23	0.51a	4.9883	-0.0791 (0.0843)	0.12	1.87b
3. Surendranagar	5.4486	0.2804 (0.2507)	0.15	0.43a	4.3762	0.0382 (0.2092)	0.005	0.33a
4. Junagadh	3.2944	0.3099 (0.3168)	0.12	0.78b	5.4836	-0.1985 (0.1432)	0.22	1.01b
5. Bhavnagar	2.6025	0.4329* (0.2239)	0.33	0.55a	3.8960	0.1193 (0.2475)	0.03	1.64b
6. Kutch	3.5687	0.2383 (0.2229)	0.14	0.43a	4.6333	-0.0224 (0.1394)	0.04	0.68c
7. Amreli	2.9692	0.3729* (0.2007)	0.30	0.63c	5.1528	-0.1343 (0.2009)	0.06	0.45a
8. Banaskantha	4.3266	0.0935 (0.2293)	0.02	0.27a	4.4413	0.0237 (0.1039)	0.01	1.23b
9. Mehsana	3.6075	0.2434 (0.3113)	0.08	0.24a	4.3720	0.0427 (0.1886)	0.01	0.75b
10. Sabarkantha	5.1238	-0.0695 (0.1828)	0.02	0.66c	3.1444	0.3034 (0.1700)	0.31	0.73c
11. Ahmedabad	3.0814	0.3792 (0.5823)	0.06	0.24a	4.0349	0.1317 (0.1400)	0.11	1.20b
12. Kaira	2.6851	0.4312 (0.4027)	0.14	0.36a	4.0575	0.0992 (0.2422)	0.02	1.11b
13. Panchmahals	5.8477	-0.2037 (0.1735)	0.16	0.63c	4.2708	0.0820 (0.0622)	0.20	2.34b
14. Baroda	-1.4301	1.3346** (0.5285)	0.48	0.96b	2.4340	0.4649 (0.4213)	0.15	1.06b
15. Broach	3.8923	0.2209 (0.4794)	0.03	0.36a	3.5851	0.2352 (0.2317)	0.13	1.57b
16. Surat	8.3341	-0.7477 (0.9931)	0.07	0.25a	3.3995	0.2586 (0.2003)	0.19	1.69b
Gujarat	2.3618	0.5117 (0.4552)	0.15	0.32a	4.824	-0.0623 (0.2324)	0.01	0.52a

Figures in parentheses indicate the standard errors of the regression coefficients.

** Significant at 5 per cent level.

* Significant at 10 per cent level.

a Durbin-Watson test indicates no serial correlation in residuals.

b Durbin-Watson test indicates serial correlation in residuals.

c Durbin-Watson test falls in the "Inconclusive" range.

Degrees of freedom=7.

caution is in order here, for the changes in productivity have not influenced the money wages in all groundnut and cotton growing districts. It seems that the reporting system of data on wage rate is yet to be standardised in the sense that probably it does not take into account the piece rate wages uniformly in all the centres, selected for the purpose of data collection.

FACTORS AFFECTING WAGE RATE

Apart from productivity, there are several other variables such as distribution of land holdings (measured by land concentration ratio), irrigated area, availability of pump-sets, tractor use, and availability of agricultural labour, playing an important role in wage determination. Since time-series data on these variables are not available, the relationship between these variables and wages has been examined on the basis of cross-section data. This section attempts to study the factors explaining the inter-district variations in wages for the year 1968-69 in Gujarat.

Model : Variables and Relationships

Both linear and exponential relationships between selected variables and wages have been estimated. The different combinations of the variables have been studied in explaining the inter-district wage differentials. These combinations are as follows :

Models :

- (1) $Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5$
- (2) $Y = a + b_1x_1 + b_3x_3 + b_5x_5$
- (3) $Y = a + b_3x_3 + b_4x_4 + b_5x_5$
- (4) $Y = a + b_1x_1 + b_5x_5$

Where :

$$Y = \text{Wage rate}$$

The wage rate has been referred here in terms of the average wage in rupees per day of male and female labour.

$$x_1 = \text{Land concentration ratio}$$

The average size of holding has generally been taken into account in explaining the variations in wages. Apart from size, the more important is its distribution affecting the wage differentials. It gives a better idea about both demand for and supply of labour. In an area of low land concentration ratio, the difference in average size of holding between small and big would be relatively low. It is, therefore, expected that there would be enough demand for labour from all the sizes of farms. This would, in turn, push up the wage level. In such a case the availability of labour is also expected to

be low, as the family labour available to the small farmers would be absorbed in their own cultivation. This may also enhance the wage level. On the other hand, if an area has high land concentration ratio, there would be a sizable number of big farmers, who may exercise their monopsonistic pressures on the labourers, which may depress the wage rate. The availability of labour in this case is likely to be higher probably due to the predominance of small farmers whose family labour may not be absorbed in their own cultivation. Therefore, on both these counts it has been postulated that in an area of high land concentration ratio, there may be low level of wages, resulting in a negative sign for its coefficient.

$$x_2 = \text{Extent of irrigated area}$$

Higher irrigated area while increasing crop intensity, raises the requirement of human labour,²³ increasing thereby the demand for labour. On the irrigated land, the productivity is also expected to be high, which shifts the demand curve for labour to the right. In view of these factors, it is expected that in the region of higher irrigated area the wage level would be high. Thus, a positive sign for its coefficient has been postulated.

$$x_3 = \text{Availability of pump-sets}$$

Since the irrigated area constitutes very small portion of the cropped area ranging from 2 to 19 per cent among districts of Gujarat,²⁴ the availability of pump-sets measured in terms of pump-sets per thousand acres of cultivated area has been considered a better measure of irrigation. It helps in obtaining higher yields due to assured supply of water at the required time. Therefore, it is expected that if an area has more pump-sets, there may be high wage level. This would result in a positive sign for its coefficient.

$$x_4 = \text{Availability of tractors}$$

There may be two views about the relationship between wages and tractor use, which is measured in terms of the tractors per thousand acres of cultivated area. First, the tractor use is expected to increase the demand of labour, particularly in areas having enough scope to increase crop intensity by the use of tractors. This would push up the wage level. The second argument is that the tractor use depresses the wage rate by displacing the agricultural labour, probably for an area having less scope to increase the intensity of cropping. In Gujarat the crop intensity in percentage terms happens to be quite low, ranging from 100.5 to 111.4 among districts,²⁵ but there does not appear to be much scope to increase it due to limited irriga-

23. C. H. Hanumantha Rao: *Agricultural Production Functions, Costs and Returns*, Asia Publishing House, 1965, pp. 72-91.

24. V. N. Misra, "Regional Variations in Agricultural Growth in Gujarat : 1949-50 to 1968," Conference Papers, Gujarat Economic Association, January, 1971.

25. *ibid.*

tion facilities. It may, therefore, be argued that the use for tractor would probably depress the level of wages by displacing the human labour. The other fact that the tractor use is more in the areas of low availability of agricultural labour gives further evidence that it is the low availability of labour that has probably compelled the cultivators to go in for the use of tractors. Therefore, its use is likely to displace labour. Thus, an inverse relationship between the tractor use and wages has been postulated.

$$x_5 = \text{Availability of agricultural labour}$$

The number of agricultural labour per acre of cultivated area has been considered as proxy variable for the supply of labour, which plays an important role in wage determination, as mentioned earlier. In an area, where the supply of labour is quite high, it is expected that the wage level would be low. This results in a negative sign for its coefficient.

The other factors such as the alternative employment opportunities, the paying capacity of the cultivators, cropping pattern, production uncertainty, etc., are also very important factors determining the wages. These factors have not been included in this study,²⁶ because the districts have been taken as observations for study, which are sixteen in number and taking all these factors into account, would have resulted in very low degrees of freedom. However, unexplained variations in the wages by our models may be assigned to these factors.

Results

All the variables included in the equations have the expected sign for both linear and exponential functions (Table III). However, only the pump-sets (x_3) and agricultural labour (x_5) turn out to be significant for all the models. The former has positive sign for its coefficients, whereas in the latter, the coefficients have negative sign, indicating that the wage rate responds positively to the variations in the availability of pump-sets, and negatively to the agricultural labourers.²⁷

From the significant negative coefficients for agricultural labourers, it may be inferred that in some of the districts particularly of Saurashtra region, which has low availability of agricultural labour, the supply curve has

26. Of these variables, the paying capacity of the cultivators measured by the per capita income of the cultivating families, alternative employment opportunities and cropping pattern have been studied earlier for Gujarat in the labour market framework. See V. N. Misra, "Labour Market in Agriculture: A Study of Gujarat Districts," *op. cit.*

27. *ibid.* In an earlier study, inter-district variations in the wage rates in Gujarat have been tried to explain by per acre hired labour (demand) and percentage of agricultural worker to total working force (supply). Though the latter has shown a negative sign for its coefficient, but it turned out to be non-significant. It seems that a better proxy for supply of labour is the per acre availability of labour, which has shown significantly negative relationship with the wages in this study rather than the percentage of agricultural labour to the total working force.

TABLE III—FACTORS AFFECTING INTER-DISTRICT WAGE DIFFERENTIALS
(REGRESSION COEFFICIENTS, STANDARD ERRORS AND R²)

Model No.	Constant term	Regression			Coefficients		R ²	Degrees of freedom
		Land concentration ratio X ₁	Percentage of gross irrigated area to gross cropped area in 1966-67 X ₂	No. of pump-sets per thousand acres of cultivated area in 1966 X ₃	No. of tractors per thousand acres of cultivated area in 1966 X ₄	Per acre agricultural labourers in 1961 X ₅		
LINEAR								
(1)	3.1245	-1.1869 (2.5379)	0.0159 (0.0343)	0.0840* (0.0438)	-0.3900 (1.1276)	-2.422** (0.8821)	0.78	10
(2)	2.9455	-0.7316 (1.1772)	—	0.0979*** (0.0273)	—	-2.4808*** (0.7952)	0.77	12
(3)	2.6377	—	—	0.1029*** (0.0237)	-0.3212 (0.8738)	2.5957*** (0.7242)	0.77	12
(4)	4.9637	-3.9190* (2.1162)	—	—	—	-2.3045* (1.0966)	0.53	13
EXPONENTIAL								
(1)	-0.0752	-0.0539 (0.4851)	0.0662 (0.1306)	0.1915* (0.0966)	-0.0533 (0.0573)	-0.2539** (0.0842)	0.82	10
(2)	0.1485	-0.0662 (0.3126)	—	0.2085*** (0.0498)	—	-0.2558*** (0.0729)	0.81	12
(3)	0.0932	—	—	0.2215*** (0.0434)	-0.0367 (0.0426)	-0.2595*** (0.0624)	0.82	12
(4)	0.0255	-0.6930* (0.3912)	—	—	—	-0.2305* (0.1095)	0.53	13

Figures in parentheses indicate the standard errors of the regression coefficients.

*** Significant at 1 per cent probability level.

** Significant at 5 per cent probability level.

* Significant at 10 per cent probability level.

a positive slope. On the other hand, in districts such as Panchmahals, Kaira, Mehsana, Sabarkantha and Surat having relatively higher availability of agricultural labourers, the shape of supply curve probably becomes perfectly elastic over a large range in these districts. Due to the existence of both the situations, *i.e.*, perfectly elastic supply curve and supply curve with a positive slope, negative coefficients for agricultural labour have been found.

In spite of the fact that there is an inverse relationship between land concentration ratio and pump-sets ($r = -0.53$, Table IV), the wages have been influenced more by land concentration ratio ($r = -0.60$, Table IV). As a result, the effect of land concentration ratio (x_1) in influencing the wages has been confounded with pump-sets (x_3). Similar is the case with irrigated area which is also confounded with x_3 . However, due to the confounding

TABLE IV—CORRELATION MATRIX

Variables		Y	X ₁	X ₂	X ₃	X ₄	X ₅
Wage rates (Rs.)	Y	1.000	-0.603	0.302	0.717	-0.165	-0.632
Land concentration ratio	X ₁		1.000	0.211	-0.527	0.420	0.456
Percentage of gross irrigated area to gross cropped area in 1966-67	X ₂			1.000	0.486	0.420	0.003
No. of pump-sets per thousand acres of cultivated area in 1966	X ₃				1.000	-0.096	-0.193
No. of tractors per thousand acres of cultivated area in 1966	X ₄					1.000	0.108
Per acre agricultural labourers in 1961	X ₅						1.000

effect of x_1 with x_3 , the former turns out significant at 10 per cent level with expected negative sign for its coefficients only after dropping x_3 (see model 4).

The extent of irrigated area (x_2) has the expected positive sign for its coefficient but turns out to be non-significant,²⁸ suggesting that the wage rate did not respond to the variations in the irrigated areas, as it constitutes very small portion of the gross cropped area. However, the fact that x_2 did not exert any influence on the wages, whereas x_3 has shown significantly positive relationship with the wages, clearly suggests that the provision of assured supply of water through own means of irrigation would increase the wages rather than the increase in the irrigated area based on canal, wells, etc., which happen to be mainly protective in nature.

In the case of tractor use also, the coefficients have expected negative sign but are non-significant. The standard errors are higher than the coefficients for both the linear and exponential functions. Therefore, nothing conclusive can be said about its impact on wages.

The values of R^2 clearly indicate that the explanatory power of the models is quite satisfactory, as these models explain about 53 to 82 per cent of the inter-district variations in the wage rate for both the linear and exponential functions. In the latter the values of R^2 are slightly higher than in the former for model 1, 2 and 3, whereas in the case of model 4 for both the

28. The proportion of irrigated area has also been found significantly related to the wage rates. See K. Bardhan, *op. cit.*; S. M. Pandey, *op. cit.*

However, Pandey has concluded that the marginal value productivity of labour is probably above zero on the basis of the sum of the coefficients (in log form) for the demand variables (which are represented by intensity of cropping, proportion of gross irrigated area, effective size of cultivated area measured by the ratio of area under cultivation to the total number of cultivators) alone are more than unity. One wonders how an inference about MVP of labour can be drawn from the coefficients of such variables.

types of functions, land concentration ratio and agricultural labour explain about 53 per cent of the inter-district wage differentials.

SUMMARY

The above discussion may be summarised as below :

1. Money wages increased over time in all the districts. But in real terms, it declined in all the districts except Ahmedabad and Surat. However, in most of districts the productivity has also shown an increase, which is slightly lower than the increase in money wages.
 2. The changes in productivity have not influenced the real wages. Similar is the case with the money wages except for Jamnagar, Bhavnagar, Amreli and Baroda where it is influenced by the productivity changes probably due to the fact there has been piece rate system of wages particularly for harvesting of groundnut and cotton in these districts.
 3. All the variables included in the equations to explain the inter-district wage differentials for the year 1968-69 in Gujarat, have the expected sign. Of course, only the availability of pump-sets and agricultural labour turn out to be significant. The former has positive sign for its coefficients, whereas in the latter the coefficients have negative sign, indicating that the wage rate responds positively to the variations in the availability of pump-sets and negatively to the agricultural labourers.
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INTER-TEMPORAL ANALYSIS OF PRODUCTIVITY AND WAGES OF FARM LABOUR IN FEROZEPUR DISTRICT (PUNJAB)

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Punjab agriculture is changing very fast. The introduction of new technology has affected agricultural production, resource use and distribution of gains to the factor owners. Based on the Farm Management Studies data, this paper aims at studying changes in labour productivity and wage rate. The specific objectives of this paper are (i) to study the labour production function and its demand for the periods 1954-57 and 1966-70 in Ferozepur district, and (ii) to examine the variation in the productivity of labour and its wages for the above period and for the district.

Part II of this study is devoted to the labour production function and demand. The changes in the productivity, wages and prices are described in Part III. The last part is devoted to conclusions.