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Improving Rural Wages in India

Shahidur R. Khandker

Do public programs and infrastructure to promote agricultural growth improve real agricultural wages and thus reduce rural poverty? Rural electrification, roads, and banks do — because they increase nonfarm employment. Educational infrastructure, public irrigation, and regulation of markets do not, although they raise agricultural output.

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Do public programs and infrastructure that promote agricultural growth improve real agricultural wages and thus reduce rural poverty?

That depends, says Khandker, basing his conclusions on district-level panel data from India.

Whether public policies increase real agricultural wages depends on whether they promote rural nonfarm employment, to absorb the growing labor force.

For example, although educational infrastructure, public irrigation, and regulation of markets raise agricultural output, they depress real agricultural wages because they do not increase nonfarm employment

In contrast, rural electrification, roads, and banks can increase real agricultural wages, because they increase nonfarm employment.

Rural financial institutions and electrification reallocate labor from agriculture to rural nonfarm activities, however, while roads promote both farm and nonfarm employment.

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Improving Rural Wages in India

by
Shahidur R. Khandker

Table of Contents

I. Introduction

The introduction of new seed technology in agriculture has enabled India to attain self-sufficiency in basic food grains. Yet, as evidence suggests, poverty remains obstinately high in many parts of rural India (Ahluwalia, 1978; Bardhan, 1985; Vaidyanathan, 1988).[1] The continued rural poverty amidst surplus food production is perhaps a result of an inadequate growth in rural employment and income (Mellor, 1988; Mellor and Johnston, 1984). Poverty alleviation thus critically depends on how fast the government can generate productive employment and income for the rural unemployed. One proximate cause of rural poverty is a slow growth in agricultural wage income. Thus, one way to alleviate rural poverty--National Sample Survey (NSS) of India reports that in 1983 about 40 percent of the rural labor force were wage workers--is to increase real rural wage.

1/ There are two ways rural poverty has been measured in the literature. One approach quantifies the incidence of poverty (i.e., in terms of the head count ratio, the Sen's index and other measures) based on the mean per capita consumption levels in rural areas and the distribution of the rural population around the mean at different points of time. The other approach looks at the trend of real wage of agricultural workers who are the majority of the rural poors.

The purpose of this paper is to identify public policy and program interventions that can increase real rural wage rates and hence reduce rural poverty.

Rural wages can only increase if the demand for rural labor grows faster than its supply. In other words, rural wages can be affected by changing both the demand for and supply of rural labor. An increase in the demand for rural labor, given its supply, can occur if there is an increased labor demand in either agricultural or nonagricultural activities. Agriculture has limited opportunities to absorb the growing labor force, however. Because of increased agricultural mechanization, the level of farm employment has stagnated or even declined in some parts of India (Bhalla, 1987; Bartsch, 1977). It is, therefore, difficult to raise agricultural real wage unless sufficient productive employment is generated in the nonfarm sector.

Because India's large-scale industrialization policy creates few jobs, employment expansion in the urban sector is not enough to pull labor out of the rural sector (Mellor, 1988).[2] Rural nonfarm growth is thus required to generate productive rural employment. The emergence and growth of rural nonfarm pursuits is, however, driven primarily by growth in rural income that leads to higher demand for rural nonfarm goods and services (Binswanger, 1983; Liedholm and Mead, 1986). Farm income and wages are important elements of rural income and thus agricultural growth may have an important influence on the growth of rural nonfarm activities and hence demand for labor. According to NSS, the share of nonfarm to total workers

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2/ Consequently, rural wages cannot be increased through a reduction in the rural labor force via labor migration.

in rural India has risen from 17 (10) percent in 1972 to 23 (13) percent in 1983 among males (females). Agricultural growth, which is about 3.5 percent over this period, perhaps has contributed to this substantial gain in rural nonfarm employment. Does this also mean an increase in real rural wages via induced labor demand?

This depends on whether rural labor demand grows faster than the supply. In the long-run rural labor supply can be slowed down if the population growth is reduced. However, labor is mobile and it is difficult to treat rural labor supply as exogenous even in the short-run. For example, government programs and interventions may create job opportunities in a particular area and attract labor from other regions.[3] Thus, the prices and infrastructure which affect output supply, employment and wage can also influence the family's labor supply and migration decisions. In other words, labor supply is a household decision influenced by some of the same factors that affect its demand for labor in production.

Because labor supply is endogenous, this paper does not attempt to relate agricultural growth to the rural real wages and nonfarm employment (Bardhan, 1985; Khan, (1983); Haggblade, Hazell and Brown, (1988). Although rural real wages and employment (both farm and nonfarm) tend to be associated with agricultural growth, their simple associations do not tell

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3/ Also government may respond to population density for the reason that the marginal cost of providing an infrastructure is lower in a high population density area than a low density one. Because both infrastructure and population influence each other, it is almost impossible to estimate the impact of infrastructure on the population density and hence rural labor supply.

us what causes what. More plausibly, they are simultaneously and jointly determined by a number of common exogenous factors influencing farm household's production and consumption decisions. This paper also, unlike other studies (e.g., Binswanger et al., 1987), does not treat population density as an exogenous variable determining output supply.

The agroclimatic endowments and infrastructure which affect agricultural output also influence agricultural employment, rural real wages and nonfarm employment. For policy purposes, it is important to know whether the policies that have fostered agricultural growth have had any powerful effect on rural wages and employment. Because the causal factors need not influence the observed outcomes in the same direction, the objective of this paper is to differentiate the factors that promote simultaneous expansion in agricultural production, real wage, farm and nonfarm employment from the factors that exert opposing effects.

A central problem of estimating the causal relationships is that public programs and infrastructural investment respond to agricultural opportunities implied by the agroclimatic potentials of an area. Government invests more in a better agroclimatic area where the return to public investment is high. The rural households also respond to better agroclimates by increasing output and thus government programs cannot be considered exogenous to the household's output decisions. Labor demand is determined by agroclimate, infrastructure and the level of output and this makes it difficult to estimate the causal effect of public programs on outcomes such as rural wages and employment. However, these problems can be circumvented if we use a panel dataset. In this paper we use a district-level panel data from 85 districts in India.

The paper is structured in the following order. An analytical model based on the theory of farm household production with estimation

technique is outlined in section two. Section three discusses the data and variables used in the paper. The empirical results are discussed in section four. The results are summarized in the concluding part of the paper.

II. Model Specification and Estimation Strategy

Assume that rural households participate both in farm and nonfarm activities.[4] Using the theory of farm household (e.g., Barnum and Squire, 1979), a household's farm and nonfarm output supply or input demand functions can be derived as functions of technology, output and input prices, both the physical and human endowments, and the existence of public institutions and infrastructure. The public institutions and infrastructure determine the "implicit" prices for many goods and services that farm households produce for market and own consumption. Government infrastructure can also directly increase production (either in farm or nonfarm activity) by shifting the production frontier as in the case of irrigation for farm production.

Let F_{jt} be farm production and N_{jt} represent rural (both the farm and nonfarm) employment of district j in period t. Equation (1) relates district-level aggregate farm production and rural employment to the following set of explanatory variables:

$$F_{jt},\ N_{jt} = g(P_{jt},\ W_{jt},\ P_{fjt},\ B_{jt},\ R_{jt},\ \mu_j;\ \delta_j) \qquad (1)$$

4/ For simplicity, assume that farm and rural nonfarm activities are highly substitutable. However, given household's endowments, a corner solution, i.e., participation only in one activity, is possible for a particular household. Such a distinction is not possible in aggregate district-level data that used in this study.

where P_{jt} is a vector of j-district's farm and nonfarm output prices in period t; W_{jt} the wage for hired labor; P_{fjt} the fertilizer price; B_{jt} the financial institutions; R_{jt} the infrastructures acting as shifters of both farm and nonfarm productions; μ_j is a vector of observable district-specific permanent characteristics; and δ_j is the district-specific unobservable characteristics influencing both the farm production and nonfarm activities.

Rural households also supply their own family labor taking W_{jt} as exogenously given; thus the aggregate labor supply in the district j, S_{jt}, can depend on the same arguments as in (1):

$$S_{jt} = h(P_{jt}, W_{jt}, P_{fjt}, B_{jt}, R_{jt}, \mu_j; \delta_j) \qquad (2)$$

We assume that a multimarket (Hicksian type) competitive equilibrium exists in the labor market, given that active labor market participation by rural households is high in the Indian villages (Rosenzweig, 1978). Moreover, both rural in- and out-migration can act to stablize the labor market equilibrium. Thus, if the demand for rural labor, N_{jt}, is greater (smaller) than the rural supply, S_{jt}, then in-migration (out-migration) or an increase (decrease) in rural labor supply depresses the market wage until an equilibrium wage is determined. Therefore, the demand for and supply of labor interact to set an equilibrium market wage which is endogeneously determined by (3).

$$W^*_{jt} = k(P_{jt}, P_{fjt}, B_{jt}, R_{jt}, \mu_j; \delta_j) \qquad (3)$$

The corresponding equilibrium aggregate crop output supply (F^*_{jt}), rural employment (N^*_{jt}), and rural labor supply (S^*_{jt}) can be written as:

$$F^*_{jt} = l(P_{jt}, P_{fjt}, B_{jt}, R_{jt}, \mu_j; \delta_j) \qquad (4)$$

$$N^*_{jt} = m(P_{jt}, P_{fjt}, B_{jt}, R_{jt}, \mu_j; \delta_j) \qquad (5)$$

The relations (3), (4), and (5), respectively, are the estimating equations for the rural wages, agricultural output, and rural employment (farm and nonfarm).

The ordinary least squares (OLS) estimation with a cross-section data (i.e., for a given t) is both biased and inconsistent, because the unobserved district-specific characteristics may be correlated with the included right-hand variables such as government infrastructure (B_j). Also, because government infrastructure variables (B_j) are not randomly distributed as often hypothesized (i.e., they are determined partially by the district's permanent factors, μ_j), the OLS estimates with cross-section data do not tell us whether it is the government infrastructure or the district's permanent attributes that matter most in explaining variation in agricultural output, wage, rural employment, and rural labor supply.

We can circumvent both the endogeneity and unobserved variable problems using a panel dataset with either a fixed or a random effects technique. If the unobserved ability characteristics are time-invariant and specific to each district, then a fixed effects procedure (i.e., dummy variable or differencing out methods) will yield consistent estimates. In contrast, the random effects procedure accounts for the existence of both the time-invariant and time-varying error components. This procedure, however, ignores any correlation between the persistent errors and time-varying observed variables. The fixed effects procedure, on the other hand, does not estimate the influence of the measured but time-invariant variables (e.g., soil moisture capacity) on the dependent variables. We shall use Hausman-Wu specification test to determine whether fixed or random effects technique is appropriate for the given data and present results accordingly.

Simultaneity may also arise because of possible endogeneity of district-level agricultural output prices (P_{jt}) and the fertilizer prices (P_{fjt}). That is, the district-level agricultural output prices (P_{jt}) are endogeneously determined by the demand for and supply of output. We circumvent this output price simultaneity by using the district-level aggregate crop price index based on the international prices of different crops using the district-specific production weights. The aggregate international crop price index is an instrument for the district-level aggregate crop output price. Given that India is a small country in virtually all international commodity markets, using international prices completely circumvents the output price endogeneity (Binswanger, Khandker and Rosenzweig, 1988).[5]

The endogeneity problem for the fertilizer price is minimal. The fertilizer price is a railhead price set by the government at the country level and hence does not respond to district-level demand for fertilizer.

III. Data and Variable definitions

For each district F_j is an aggregate crop index of 20 major crops. No data exist on nonfarm rural wages and the agricultural wage is used as a proxy for rural wages. W_j is the daily real wage rate of male agricultural labor. The wage rate for fieldworker/ploughman is used. N_j measures rural employment. Two stock measures of rural employment are considered which both derive from the decennial population censuses. One is the

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5/ Using district-level farm harvest prices, however, may not create endogeneity in the nonfarm employment equation.

agricultural employment measured by the number of male persons employed in agriculture as wage workers and the nonfarm employment measured by the total (male and female) persons employed in rural nonfarm activities. In the census employment is measured by occupational status of main workers, i.e., individuals are asked whether they worked in agriculture or non-agriculture for atleast 183 days in the last year prior to the census period. The reason for including female labor in rural nonfarm activities is that women are more active in nonfarm than farm activities. Rural nonfarm activities include activities such as mining and quarrying, manufacturing, processing, servicing, and repairs, construction, trade and commerce, transport, storage and communications, and other services. The crop and wage data are drawn from the data series for 85 districts covering a period of 21 years from 1961 to 1981 used for another study (Binswanger, Khandker and Rosenzweig, 1988). However, because of lack of comparable employment definition used in the census, the employment data from 1961 population census could not be included. The number of districts covered in this paper is 85 which are randomly selected from 13 states of India.

The price variables are the aggregate crop price index and fertilizer price index. The price indices are deflated by the consumer price index for agricultural workers using 1975 as the base year. The infrastructure (physical, financial and human) variables include the government irrigation (i.e., area irrigated by canal and tank), the number of regulated markets, the number of rural and semi-urban commercial bank branches, the number of villages electrified, the number of villages with primary school and the road length. All the infrastructure variables are normalized by the district's total geographic area. The persistent time-invariant agroclimatic endowments and locational factors are the length of

rainy season in months, the number of months in a year with excessive rain (where rainfall exceeds potential evapotranspiration), the number of cool months when the mean temperature is below 18 degree farenheit (this is related to the ability to grow wheat), an index of the moisture capacity of the soils in the district, the percentage of district's area under actual or potential irrigation scheme, the percentage of district's area liable to flooding and the district's nearest distance from one of the eight major urban centers in India (i.e., Delhi, Bombey, Calcutta, Hyderabad, Madras, Kanpur, Ahmedabad and Banglore). The only time-varying agroclimatic endowment included in the regression is the district's annual rainfall in millimeter. Annual rainfall is expected to affect the flow outcomes such as agricultural output and wages but not the stock variables such as employment status of a population at different points of time. The mean and standard deviation of the variables are given in table 1. For details on data and variable definition, see Binswanger, Khandker and Rosenzweig, 1988.

TABLE 1: Variable Definition and Descriptive Statistics

Variable	Number of Observations	Mean	Standard Deviation
Dependent Variables			
Agricultural crop output index	1785	1.192	1.044
Agricultural (male) employment/10 sq. km	170	235.492	196.889
Nonfarm (total) employment/10 sq. km.	170	153.989	206.158
Agricultural real (male) wage, Rs/manday	1785	5.051	2.035
Independent variables			
Govt. irrigation, '000 ha/10 sq. km.	1785	0.085	0.106
Number of villages with primary schools /10 sq. km	1785	1.140	0.605
Electrified villages, number/10 sq. km	1785	0.688	0.764
Commercial banks, rural branches/10 sq. km	1785	0.069	0.108
Regulated markets, numbers/10 sq. km	1785	0.014	0.022
Total road length, '000 km/10 sq. km	1785	4.389	4.277
Aggregate real domestic crop price index	1785	0.968	0.295
Aggregate real international price index	1785	0.687	0.355
Fertilizer price index (real)	1785	3.413	0.505
Annual rainfall (mm)	1785	1138.573	986.503
Length of rainy season in months	85	3.653	1.368
Number of excess rainy months	85	1.236	1.393
Number of cool months (Temp < 18°)	85	0.935	1.313
Percentage of district area liable to flooding	85	1.389	3.531
Irrigation potential, percentage	85	30.001	31.897
Urban distance (km)	85	298.441	152.029
Soil moisture capacity index	85	2.349	1.008

IV. The Results

The results of joint estimations of agricultural output, rural employment, and real wage are presented in table 2. The Hausman-Wu test suggests that the estimated chi-square statistic is not sufficient to reject the random effect method in favor of fixed effect for explaining variation in growth in the agricultural output, rural employment, real wage and population.[6] The results thus indicate that the measured agroclimatic endowments used in the regression represent a sufficiently precise quantitative characterisation of the agroclimatic potential of a district.

An increase in agricultural output price increases crop output and both farm and nonfarm employment. Whether this increases rural wages is not clear, however. Thus, the idea that increasing farm harvest prices can benefit the rural poors more than it hurts them by raising the food prices (Lipton, 1984; Tyagi, 1979) is not evident in this dataset. The response of an increase in agricultural output price is the highest for rural nonfarm employment with an elasticity of 0.20 followed by agricultural output with an elasticity of 0.19 and agricultural employment with an elasticity of 0.15.

A 10 percent increase in the price of fertilizer decreases agricultural output by 21 percent because of a negative profit effect on output and income. The same percent increase in the fertilizer price

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6/ For a small number of time periods and large number of cross-section units, it is better not to reject the random effects model unless the estimated chi-square statistics is sufficiently higher than the critical level (Maddala, 1987).

increases rural wages by 13 percent, perhaps implying increased demand for agricultural labor to substitute fertilizer in farm production.

Government investment on roads has a positive effect on crop output, rural nonfarm employment and agricultural real wages. The results suggest that better roads increase both the farm and nonfarm productions and hence agricultural real wages because of induced labor demand. The response of an increase in road investment is the highest for rural nonfarm employment with an elasticity of 0.2 followed by agricultural employment with an elasticity of 0.07, agricultural output with an elasticity of 0.06 and rural wages with an elasticity of 0.04.

Government irrigation increases agricultural output and yet reduces rural wages. Irrigation attracts more labor than it perhaps provides jobs and thus depresses rural wages. A 10 percent increase in government irrigation increases agricultural output by about 6 percent, a significant effect of public irrigation on the private output supply. It reduces agricultural real wage by about 4 percent.

Table 2: Effects of Agroclimatic Endowments, Infrastructure, Banks and Prices on Agricultural Output, Wage, Rural Employment and Population

Explanatory Variable	Aggregate crop output	Agricultural employment	Nonfarm employment	Agricultural real wage
Aggregate real crop price (lagged)[a]	0.194	0.150	0.204	0.002
	(9.161)*	(3.244)*	(2.185)*	(0.144)
Real fertilizer price[a]	-0.214	0.244	0.012	0.133
	(-3.989)*	(0.715)	(0.032)	(3.236)*
Road[a]	0.056	0.074	0.241	0.035
	(2.017)*	(0.782)	(2.559)*	(1.697)*
Government irrigation[a]	0.056	0.014	0.070	-0.038
	(1.738)*	(0.220)	(1.071)	(-1.653)*
Regulated markets[a]	0.202	0.056	-0.048	-0.021
	(12.804)*	(1.637)*	(-1.282)	(-1.748)*
Commercial banks[a]	0.039	-0.068	0.292	0.044
	(3.842)*	(-2.694)*	(10.942)*	(5.582)*
Primary schools[a]	0.177	0.172	-0.527	-0.238
	(2.496)*	(1.214)	(-3.572)*	(-4.483)*
Rural electrification[a]	0.112	-0.061	0.112	0.061
	(6.399)*	(-1.636)*	(3.034)*	(4.581)*
Year	-0.019	1.552	0.279	0.045
	(-6.659)*	(1.394)	(0.361)	(4.984)*
Rainfall x10[3]	0.071			0.136
	(3.293)*			(1.963)*
Soil moisture capacity	-0.079	-12.768	-9.741	-0.089
	(-1.059)	(-0.542)	(-0.652)	(-0.460)
Urban distance	-0.0004	0.158	0.025	0.001
	(-0.546)	(0.941)	(0.232)	(0.922)
Length of rainy season	0.142	53.896	29.318	-0.067
	(1.752)*	(2.095)*	(1.790)*	(-0.822)
Excess rain months	0.037	18.533	36.769	0.042
	(0.473)	(0.758)	(2.381)*	(0.213)
Cool winter months	0.053	-39.855	13.447	0.364
	(0.836)	(-2.024)*	(1.072)	(2.234)*
Flood potential	-0.032	1.265	-3.803	-0.057
	(-1.315)§	(0.168)	(-0.798)	(-0.915)
Irrigation potential	0.011	2.264	1.155	0.019
	(3.606)*	(2.390)*	(1.899)*	(2.488)*
Constant	1.089	-288.294	-100.866	0.970
	(2.448)*	(-1.865)*	(-1.004)	(0.807)
F-statistic	93.011	12.603	45.316	63.333
Hausman-Wu (chi-square)	27.576	19.721	19.450	25.083
Number of observations	1785	170	170	1785

Note: t-Statistics are in parentheses. Asterisk refers to significance level of 10 percent or better on a two-tail test. § refers to significance level of 10 percent on a single-tail test.

[a] Coefficients are in elasticity form at the variable means.

Similarly, regulated market development, although it increases agricultural output and employment, does not increase either rural nonfarm employment or the agricultural real wage. The response of an increase in regulated market development is the highest for agricultural output with an elasticity of about 0.2 followed by agricultural employment with an elasticity of 0.1. Market regulation reduces price uncertainty the farmers face and thus encourages farmers to produce more and employ more labor in production. However, it decreases rural wages, because it possibly reduces rural nonfarm employment. The results suggest that the extra farm output is not primarily produced by added extra farm labor.

Commercial banks expansion in rural areas increases rural households' access to both the fixed and working capital at lower transactions cost. Commercial bank expansion has a particularly powerful effect on rural nonfarm employment. Its positive effect on agricultural output is also significant. Commercial banks reduce, however, farm employment, i.e., they lead to a reallocation of labor to the rural nonfarm sector. Overall the labor market effect is positive as evidenced by the positive impact on the agricultural wage.

Government investment in primary school expansion has a positive effect on agricultural output, but a negative effect on rural nonfarm employment and agricultural real wage. Primary school expansion helps increase farmer's schooling which may encourage farmers to substitute urban nonfarm goods for rural nonfarm goods in consumption (if rural nonfarm goods are inferior) and hence reduces rural nonfarm employment. The reduced nonfarm employment in turn increases labor supply in agriculture which consequently reduces the agricultural wage.

Similar to the effect of commercial banks, rural electrification has a positive effect on agricultural real wage by reallocating rural labor

from agriculture to rural nonfarm activities. Rural electrification possibly encourages farm mechanization and hence reduces farm employment. However, it increases agricultural wage by inducing labor demand in rural nonfarm activities. The response of government investment in rural electrification is the highest for both the rural nonfarm employment and agricultural output with an elasticity of 0.11 followed by agricultural real wage with an elasticity of 0.06. Its response elasticity for farm employment is -0.06.

The rainfall has a positive effect on both the agricultural output and real wage. These results are consistent with expectations. Unlike output and wage variables, employment (both farm and nonfarm) data come from the decennial census and so annual rainfall is not expected to influence the employment status of rural population.

The effects of agroclimatic endowments measure their direct impacts on the dependent variables other than via their impact on public institutions and infrastructure. Agricultural wage growth is higher in area where irrigation potential is high, i.e., where growth in agricultural output, farm and nonfarm employment is favorable. Agricultural wage growth is also high in wheat producing regions (i.e., where the number of cool months is high). Also, growth in farm and nonfarm employment is high in areas with high rainy months.

V. Discussion

Agricultural growth via new seed technology is expected to reduce rural poverty because of its induced demand and linkage effects on rural wage and employment. This paper has examined whether agricultural growth in India has resulted in an increase in rural wages and employment and hence reduced rural poverty.

This paper did not attempt to relate agricultural changes with agricultural real wage and rural employment. What it attempted is to establish causal linkages between the sources of growth in agriculture and the factors that determine agricultural real wage and rural employment. The aim was to identify whether the policies that have fostered agricultural growth have promoted or discouraged agricultural real wage, rural employment and population. A reduced-form estimation technique is utilized to examine the causal factors that jointly influence the growth in agricultural production, real wage and rural employment. A judicious use of a panel data drawn from randomly selected 85 districts of India has circumvented both the endogeneity and unobserved variable problem that otherwise produce biased and inconsistent estimates with cross-section data.

The permanent agroclimatic characteristics are important determinants of rural wage and employment. Agricultural real wage and rural nonfarm employment grow in areas with better agroclimates favorable to agricultural growth. A positive association exists between agricultural growth and rural real wage via the agroclimatic potentials. This, of course, does not imply that the "green revolution" influenced by the agroclimatic potentials can benefit the rural poors. Whether the rural poors can benefit from new seed technology and hence agricultural growth depends on whether agricultural growth encourages labor use both in farm and nonfarm activities.

Among the price factors, agricultural output price has a positive effect on agricultural production, farm and rural nonfarm employment. An increase in fertilizer price decreases agricultural output, but increases agricultural wage because increased fertilizer price induces farmers to substitute fertilizer for labor.

Among the nonprice factors, road investment, commercial bank expansion and rural electrification can increase rural real wage and hence alleviate rural poverty by increasing rural employment. However, road investment increases both the farm and nonfarm employment, while banking expansion and rural electrification reallocate labor from agriculture to rural nonfarm activities. In contrast, education infrastructure, public irrigation and regulated market, although they promote agricultural output and employment, decrerase rural real wages, because they do not promote nonfarm employment to absorb the growing labor force.

In order to see the impact of major policy variables on the growth of agricultural real wage, rural employment and agricultural output we tabulate in table 3 their estimated impact for the decade of the 1970s. These estimates are the percentage change in the dependent variable caused by the changes in the independent variables, estimated as the product of the change in the independent variable times the regression coefficient which is divided by the average value of the dependent variable.

Agricultural crop (real) price has increased by 13 percent in the decade of 1970s. This increase in crop prices has resulted in an increase in agricultural output by 4 percent, and farm and rural nonfarm employment by about 3 percent. The fertilizer price, which has increased by 5 percent, has decreased crop output by 12 percent, but increased agricultural real wage by almost 1 percent.

An increase in road density by about 37 percent in the 1970s has increased agricultural output by 2 percent, rural nonfarm employment by about 9 percent, and agricultural real wage by 1.4 percent. An increase in government irrigation by 5 percent has increased agricultural output by about one-third of a percent while decreased agricultural real wage by .02 percent. An increase in primary school density by 26 percent has increased agricultural output by 4 percent, while decreased rural nonfarm employment by 14 percent and agricultural real wages by 6 percent.

An increase in rural electrification by 69 percent in the 1970s has contributed to the growth in agricultural output by about 9 percent, rural nonfarm employment by about 8 percent and real wage by 5 percent. It also has reduced agricultural employment by 4 percent. The gain in rural nonfarm employment has more than offset the loss in agricultural employment and thus managed to raise agricultural real wage by 5 percent. Rapid commercial bank expansion (nearly 98 percent) has increased rural nonfarm employment by nearly 29 percent, much more than the decrease in agricultural employment (7 percent) and thus increase agricultural real wage by almost 6 percent, even more than the increase in agricultural output itself (about 5 percent). The results suggest that better geographic coverage of the banking system and rural electrification can help the rural landless poors more than they help the farmers.

Table 3 : Contributions of Different Factors to Growth in Agricultural Output, Wage, Rural Employment and Population 1970-80

Variable	Aggregate crop output	Agricultural employment	Rural Nonfarm employment	Agricultural real wage
Agricultural output price	0.036*	0.030*	0.027*	0.031
Real price of fertilizer	-0.012*	0.012	0.001	0.006*
Road	0.021*	0.027	0.069*	0.014*
Government irrigation	0.003*	0.001	0.004	-0.002
Primary schools	0.044*	0.044	-0.136*	-0.061*
Rural electrification	0.090*	-0.039*	0.078§	0.052*
Commercial banks	0.048*	-0.067*	0.289*	0.056*
Regulated market	0.120*	0.031*	-0.026	-0.013*
Growth explained by all factors	0.350	0.039	0.326	0.053
Actual growth	0.179	0.139	0.347	-0.005

Note: Asterisk refers to significance level of 10 percent or better on a two-tail test. § refers to significance level of 10 percent on a single-tail test

An increase in the regulated markets in the 1970s by almost 55 percent has increased agricultural output and farm employment by 12 and 3 percent, respectively. It also decreased agricultural real wage by 1.3 percent.

During the seventies agricultural output has actually grown by 18 percent, agricultural employment by 14 percent, and rural nonfarm employment by nearly 35 percent (table 3). Yet these changes are not enough to reduce rural poverty as agricultural real wage has reduced by about 1 percent over this period. This is partly because of insufficient growth in rural employment (both farm and nonfarm) and partly because of high population growth.

Agricultural growth does not, therefore, necessarily reduce rural poverty. The underlying causal factors that promote agricultural growth may discourage a commensurate growth in rural wage and employment. The results suggest that commercial bank expansion, road improvement and electrification can contribute to the growth of agricultural real wage, because they promote rural nonfarm employment. Rural electrification and bank expansion appear to create more jobs in the rural nonfarm sector than they subtract it from agriculture. In contrast, primary school expansion, canal irrigation and regulated markets which can foster agricultural output and employment may decrease rural wages, because they do not promote rural nonfarm employment. Thus, conscious public investment decisions are needed to counter the negative wage effects of some agricultural output-expansionary government measures and hence mitigate rural poverty.

REFERENCES

Ahluwalia, M.S.., 1978. "Rural Poverty and Agricultural Performances in India". Journal of Development Studies, vol. 14 (April): 293-323.

Bhalla, S., 1987. "Trends in Employment in Indian Agriculture, Land and Asset Distribution". Paper presented at the 47th annual conference of the Indian Society of Agricultural Economics (University of North Bengal, September 24-26).

Bardhan, P.K., 1985. "Poverty and 'Trickle-Down' in Rural India: A Quantitative Analysis", in Mellor and Desai (eds.), Agricultural Change and Rural Poverty. (Baltimore: Johns Hopkins University Press).

Barnum, H.N,, and L. Squire, 1979, A Model of an Agricultural Household: Theory and Evidence, Baltimore: The Johns Hopkins University Press.

Bartsch, W.A., 1977. Employment and Technology Choice in Asian Agriculture (Geneva: International Labor Organization).

Binswanger, H.P., 1983. "Agricultural Growth and Rural Nonfarm Activities." Finance and Development (June):38-40.

Binswanger, H.P., S.R. Khandker and M.R. Rosenzweig, 1988. "The Impact of Infrastructure and Financial Institutions on Agricultural Output and Investment in India," mimeo, (Washington, D.C.: The World Bank).

Binswanger, H.P., M. Yang, A. Bowers and Y. Mundlak, 1987, "On the Determinants of Cross-Country Aggregate Agricultural Supply," Journal of Econometrics, Vol. 36, p. 111-131.

Haggblade, S., P. B. Hazell and J. Brown, 1988. "Farm-Nonfarm Linkages in Rural Sub-Saharan Africa", Agriculture and Rural Development Department Working Paper No. 6 (Washington, D.C.: The World Bank).

Khan, A. R., 1983. "Real Wages of Agricultural Workers in Bangladesh" in A.R. Khan and Eddy Lee (eds.) Poverty in Rural Asia, (Bangkok: International Labor Organization).

Liedholm, C., and D. Mead, 1987. "Small-scale Industries in Developing Countries: Empirical Evidence and Policy Implications". East Lansing: Michigan State University.

Lipton, M., 1984. "Urban Bias Revisited". Journal of Development Studies, vol. 20 (April): 139-166.

Maddala, G.S., 1987, "Limited Dependent Variable Models Using Panel Data." Journal of Human Resources, Vol. XXII, Summar: 307-338

Mellor, J. W., 1983. "Food Production, Consumption and Development Strategy", in R. B. Lucas and G. F. Papanek (eds.). The Indian Economy: Recent Development and Future Prospects (Boulder: Westview Press).

Mellor, J. W., and B. F. Johnston, 1984. "The World Food Equation: Interrelations Among Development, Employment, and Food Consumption," Journal of Economic Literature. Vol. XXII (June): 531-574.

Rosenzweig, M.R., 1978. "Rural Wages, Labor Supply, and Land Reform: A Theoretical and Empirical Analysis." American Economic Review, Vol. 68 (December): 847-861.

Tyagi, D.S., 1979. "Farm Prices and Class Bias in India". Economic and Political Weekly, vol XVI, No. 39.

Vaidyanathan, A., 1988. "Agricultural Development and Rural Poverty", in Lucas and Papanek (eds.). The Indian Economy: Recent Development and Future Prospects. (Boulder: Westview Press).

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