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THE RELATION BETWEEN RICE PRICES AND WAGE RATES IN BANGLADESH

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INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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CONTENTS

FOREWORD

In early 1989, the International Food Policy Research Institute entered into a contract with the U.S. Agency for International Development (USAID), Dhaka (under Contract No. 388-0027-C-00-9026-00) to conduct research on food policies and to extend technical assistance to the Ministry of Food, Government of Bangladesh. The Bangladesh Food Policy Project is the basis for a tripartite collaboration between IFPRI, the Government of Bangladesh, and USAID, Dhaka. This project consists of four subprojects and a large number of well-defined research topics. The subprojects together constitute a comprehensive approach for addressing the food policy problems of Bangladesh. The subprojects include the following studies: a price stabilization framework encompassing public and private marketing, evaluation of the effects of targeted distribution of foodgrains on consumption and nutrition, diversification of agriculture as a source of sustained growth of production, and capacity building in food policy analysis.

Raisuddin Ahmed

Series Editor and Project Director,
Bangladesh Food Policy Project

1. INTRODUCTION

Raisuddin Ahmed

The relation between rice prices and wage rates, particularly wage rates of unskilled laborers, is of immense practical relevance to the food policy debates of Bangladesh. The ultrapoor in Bangladesh earn most of their income from wages, and they spend about 60 percent of their income on foodgrains. Therefore, both the wage rate and the rice price are of critical concern to them. In the past the general argument against a high rice price was the consideration of adverse income effects of such prices on the welfare of the poor. In recent years, this line of logic has been countered with the argument that such adverse effects on the poor are limited to the short run. In the long run, the poor also benefit from higher rice prices due to the positive relationship between wages and price of staples. The search for a reliable answer to this important question, which is so central to the price policy debates in Bangladesh, is the primary objective of the two essays presented here.

The paper by Thamarajakshi describes the behavior of foodgrain supply, prices, wage rates, and employment over time. This presentation is useful for those who want to look at trends of interrelated variables in order to derive lessons from them.

In the second paper, Ravallion makes a sophisticated analytical effort to measure the magnitude and direction of relations between rice prices and wage rates in Bangladesh. The pertinent conclusions from Ravallion's analysis are worth listing here:

1. In the short run, the rural rich are likely to gain and the rural poor to lose from an increase in the relative price of food staples. This conclusion is confirmed by both partial equilibrium and static quasi-general equilibrium frameworks of analysis.

2. Earlier studies, based on partial analyses, indicate that an increase in rice price is unlikely to be passed on fully in the agricultural wage rate, even in the long run. Ravallion's comprehensive analysis shows that the welfare of a typical poor household is more likely to be neutral to the change in the price of rice in the long run. However, the most interesting aspect of this analysis is that the long-run welfare effect varies among the poor. This is contrary to intuitions based on partial equilibrium analyses, which ignore the wage response. Among the poor, the effect on welfare of a price increase appears more likely to be positive for the poorest households than for those who are less poor.

3. Finally, the study shows that it would typically take three or four years before price increases ceased to have an adverse effect on welfare of the rural poor.

In looking at the short- and long-run effects of higher prices of food staples, one must consider ways to counter some of the adverse effects of foodgrain prices in the short run in order to attain the growth and equity objectives, which are not inconsistent in the long run. The IFPRI Bangladesh Food Policy Project is expected to shed light on the formulation of such integrated policies when all other components of the project are completed.

2. FOODGRAIN SUPPLY, PRICES, WAGES, AND EMPLOYMENT IN BANGLADESH

R. Thamarajakshi*

INTRODUCTION

Foodgrain prices, food supplies, and real consumer purchasing power are all dynamically related, each affecting the levels and variations in the others. In the dynamic context, technological and institutional change both have effects on production, employment, and prices. Targeted and untargeted interventions by government in the foodgrain markets influence foodgrain availability and prices, as well as wages and employment. This paper examines some of these interrelationships for Bangladesh in recent years. The study covers rural labor supply and wages, based on secondary sources of information.

FOODGRAIN PRODUCTION AND AVAILABILITY

As a result of technological progress, the trend rate of growth of cereal production rose from 2.6 percent per year for the 1950-71 period to 3.4 percent for the 1971-85 period (Hossain 1988). Recently, growth has been reportedly decelerated compared with the mid-1970s; the rate of growth of foodgrain output has declined from 3 percent in the mid-1970s to about 2.2 percent in the 1980s (Government of Bangladesh, Planning Commission 1990). This slowdown has been associated *inter alia* with a slowdown in the rate of growth of area under irrigation, deficiencies in certain mineral nutrients such as sulfur and zinc, decreasing seed quality, and diminishing productivity with extension of high-yielding varieties (HYVs) to less endowed areas.[1]

Domestic production has been, on the aggregate, lower than the level corresponding to the normative requirement of 16 ounces per day per person (Table 1). To ameliorate the problem of foodgrain deficits, the government operates a public food distribution system through internal procurement and imports. The public food distribution system has contributed as much as 13 percent of total availability. Using the

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* The author is grateful for the computational assistance provided by Jinnat Ali and by Kibria Masud, research assistants, IFPRI, Dhaka.

[1] The Agriculture Sector Review for Bangladesh, sponsored by the United Nations Development Programme, refers to the declining rate of profitability, particularly of the winter cereals, but also adds that this could be in large part a function of the overall economic conditions (see UNDP 1989).

guidelines of 16 ounces per day per person for intake, 15 out of 21 districts and 262-298 upazilas out of a total of 495 upazilas have been identified as deficit areas (Tables 2 and 3) (Giasuddin and Hamid 1986).

According to the Bangladesh Bureau of Statistics (1988), a minimum per capita daily intake of 2,122 calories is taken as the first poverty line and 1,805 calories as the hard-core poverty level. Yet another study by the Bangladesh Institute of Development Studies (BIDS) defines per capita minimum caloric daily requirement as 2,112 calories, with a minimum of 437 grams of rice and wheat, equivalent to 1,525 calories (Rahman and Haque 1988). On the basis of the minimum income level needed for these minimum cereal requirements,[2] nearly 85 percent of the households with chronic deficits own less than 0.50 acres, whereas their percentage in the total population is less than 50 percent (Table 4). It has been estimated that about 80 percent of agricultural labor households are in poverty (Hossain and Quasem 1990).

Table 1--Foodgrain production and availability, 1974/75-1987/88

Year	Production (gross)			Net production*	Total availability	Per capita availability
	Rice	Wheat	Total			
	(1,000 metric tons)					(ounces/day)
1974/75	11,287	117	11,404	10,263	11,919	14.73
1975/76	12,762	218	12,980	11,682	12,955	15.65
1976/77	11,752	259	12,011	10,810	11,954	14.10
1977/78	12,967	348	13,316	11,984	13,305	15.32
1978/79	12,849	394	13,343	12,009	13,473	15.15
1979/80	12,737	823	13,560	12,203	14,307	15.15
1980/81	13,832	1,092	14,974	13,476	13,990	15.02
1981/82	13,630	967	14,597	13,137	14,903	15.64
1982/83	14,215	1,095	15,310	13,779	15,519	15.68
1983/84	14,506	1,211	15,718	14,146	15,930	16.01
1984/85	14,620	1,464	16,084	14,476	16,690	16.46
1985/86	15,037	1,042	16,079	14,471	15,663	15.09
1986/87	15,496	1,091	16,587	14,928	16,361	15.90
1987/88	15,346	1,050	16,396	14,756	17,017	15.79

Source: Bangladesh, Ministry of Food, Food Policy and Monitoring Unit, Food Situation Report, June 1989.

* Net production is gross production minus 10 percent for seed, feed, and waste.

[2] Estimation of the poverty line in the BIDS study (Rahman and Haque 1988) is made on the basis of per capita minimum requirements of cereals and other food items and after making provision for nonfood basic needs at 25 percent expenditure on food.

Table 2--Foodgrain production surplus or deficit in districts, 1982-84

District	Number of Upazilas	Population			Production			Requirement			Surplus of Deficit			Percentage Surplus		
		1982	1983	1984	1982	1983	1984	1982	1983	1984	1982	1983	1984	1982	1983	1984
		(1,000 persons)						(1,000 metric tons)						(percent)		
Mymensingh	35	7,111	7,280	7,494	1,490	1,474	1,543	1,177	1,205	1,241	313	269	302	27	22	24
Jamalpur	13	2,640	2,669	2,759	553	522	507	437	442	457	116	80	50	27	18	11
Tangail	11	2,618	2,687	2,747	572	498	463	433	445	455	139	53	8	32	12	3
Dhaka	49	10,663	10,938	11,263	838	764	702	1,765	1,811	1,884	-927	-1,047	-1,162	-53	-58	-62
Faridpur	27	5,095	5,225	5,359	590	571	531	843	865	887	-253	-294	-356	-30	-34	-40
Dinajpur	23	3,442	3,512	3,599	727	728	679	570	581	596	157	147	83	28	25	14
Rangpur	36	6,958	7,137	7,325	1,346	1,409	1,285	1,152	1,181	1,213	194	228	72	17	19	6
Bogra	16	2,918	2,994	3,068	596	637	645	483	496	508	113	141	137	23	29	27
Pubna	18	3,660	3,752	3,851	512	529	489	606	621	637	-94	-32	-148	-15	-15	-23
Rajshahi	32	5,635	5,776	5,927	803	899	842	933	956	981	-130	-57	-139	-14	-6	-14
Kushtia	12	2,453	2,515	2,578	294	301	305	406	416	427	-112	-115	-122	-28	-28	-29
Jessore	21	4,300	4,408	4,521	613	556	613	712	730	748	-99	-174	-135	-14	-24	-18
Khulna	26	4,644	4,750	4,870	636	597	681	769	786	806	-133	-189	-125	-17	-24	-16
Barisal	28	4,930	5,122	5,249	627	762	629	826	948	869	-199	-86	-240	-24	-10	-26
Patuakhali	12	1,973	2,022	2,072	379	358	322	327	335	343	52	23	-21	16	7	-6
Chittagong	27	5,875	6,027	6,176	680	777	775	973	998	1,022	-293	-221	-247	-30	-22	-24
Noakhali	16	4,081	4,185	4,292	579	636	670	676	693	710	-97	-57	-40	-14	-8	-6
Chittagong Hill Tract	27	573	587	601	59	61	70	95	97	99	-36	-36	-29	-38	-37	-30
Banderban	8	154	159	163	17	14	15	25	26	27	-8	-12	-12	-33	-47	-44
Comilla	26	7,362	7,548	7,739	1,107	1,078	1,143	1,219	1,249	1,281	-112	-171	-138	-9	-14	-11
Sylhet	37	6,052	6,204	6,362	6,362	1,036	1,043	1,002	1,027	1,053	66	-9	-10	7	1	-i
Bangladesh	495	93,197	95,497	98,015	14,086	14,207	13,952	15,427	15,808	16,225	-1,341	-1,601	-2,273	-9	-10	-14

Source: Md. Giasuddin and A. Hamid, Foodgrain Surplus or Deficit Districts and Upazilas of Bangladesh. FPMU Publication 3 (Dhaka: Bangladesh Ministry of Food, Food Policy and Monitoring Unit, 1986)

Table 3--Number of upazilas with foodgrain surpluses or deficits, 1982, 1983, and 1984

District	Number of Upazilas	1982		1983		1984	
		Surplus	Deficit	Surplus	Deficit	Surplus	Deficit
		(number of upazilas)					
Mymensingh	35	22	13	25	10	26	9
Jamalpur	13	11	1	9	3	8	4
Tangail	11	9	2	5	6	4	7
Dhaka	49	6	43	4	45	1	48
Faridpur	27	3	24	3	24	2	25
Dinajpur	23	20	3	18	5	14	9
Rangpur	36	18	7	27	8	22	13
Bogra	16	12	4	13	3	13	3
Pubna	18	6	12	7	11	5	13
Rajshahi	32	14	18	16	16	12	20
Kushtia	12	3	8	2	10	0	12
Jessore	21	9	12	4	17	4	17
Khulna	26	12	14	9	17	13	13
Barisal	28	6	22	6	22	7	21
Patuakhali	12	10	1	6	5	7	4
Chittagong	27	7	20	8	19	7	20
Noakhali	16	8	8	8	8	9	7
Chittagong Hill Tract	22	4	14	6	12	4	14
Banderban	8	2	4	2	4	2	4
Comilla	26	9	17	7	19	6	20
Sylhet	37	22	14	23	13	21	15
Bangladesh	495	223	262	208	277	187	298

Source: Md. Giasuddin and A. Hamid, Foodgrain Surplus or Deficit Districts and Upazilas of Bangladesh (Dhaka: Bangladesh Ministry of Food, Food Policy and Monitoring Unit, 1986)

Note: Information for 10 upazilas/thanas was not available.

DIMENSIONS AND CHARACTERISTICS OF AGRICULTURAL LABOR

Agricultural laborers make up a large part of the rural labor force in Bangladesh. Estimates range from 66 percent (BBS 1988) to 75 percent (BBS 1984) of the total force depending upon the year and the definition of agricultural laborer used. The most recent agricultural census, based on household level data, was for the 1984/85 crop year. That census determined that 31 percent of farm households and 63 percent of non-farm households relied upon income from agricultural labor as the main source of income (BBS 1986). It found that agricultural labor was important for nonfarm households due to the lack of other sources of employment. Hossain (1986) estimated the number of landless households to be 4.8 million in 1982 and functionally landless households to be 6.1

Table 4--Distribution of deficit households according to landownership, 1989/90

Landownership Category	Total Households	Chronic or Occasionally Deficit Households	Households with Chronic Deficits
		(percent)	
Landless	16	19	29
Functionally landless (0.01-0.49 acres)	33	40	55
Marginal owner (0.50-1.49 acres)	21	21	11
Small owner (1.50-2.49 acres)	11	10	3
Medium owner (2.50-4.99 acres)	12	8	1
Large owner (over 5 acres)	7	2	1
Total	100	100	100

Source: BIDS (Bangladesh Institute of Development Studies) "Analysis of Poverty Trends Project, 62 Village Survey, 1989/90", p. 73.

million; together they constitute about 70 percent of all households in the country. Hossain defined landless wage laborers as those who hire out labor for agricultural activities and those who are primarily engaged in nonfarm activities.

While estimates vary, it is clear that there is a very large proportion of the population that is vulnerable to food insecurity. Further, studies have reported an increase in the number of landless households (Hossain 1986; Abdullah and Murshid 1986b). The primary concern of these of people is food, both the level of food prices and their fluctuations. Government policies for food should therefore give greater weight to the immediacy of the needs of these large numbers of people, when calculating the costs and benefits of their policies.

It is well known that employment measurement is complicated in economies like Bangladesh where the predominant sector, agriculture, is characterized by seasonality of operations and family labor participation. There is very little open unemployment. The reported rate of unemployment in rural areas, according to BBS (1985), was only 1.6 percent in 1984/85. However, employment does not grow as fast as the labor force, and unemployment elasticities with respect to output are not high. Yield elasticities of employment are reported to vary between 0.2 and 0.5 for various types of yield-increasing operations, including the shift from traditional varieties to HYVs (Osmani 1987b, Islam 1989). It is estimated that during the period 1967-70 through

1979-82 the labor force grew at 1.9 percent per year, while employment in the crop sector expanded by only 0.85 percent per year (Ahmed 1988). More than 88 percent of the unemployed rural labor force remained unemployed for more than 24 weeks during 1984/85 (Table 5) (BBS 1988). Although food production growth has occurred, it is reportedly not adequate: as a result, landlessness has been on the rise, augmenting agricultural labor supplies (Osmani 1987b). During the period 1986-95 the rural labor force is expected to increase by 5 million people; crop production will absorb only about 30 percent of that increase (Parthasarathy 1989).

The seasonal variations in demand for agricultural labor and associated fluctuations in wages arising out of seasonal variations in food production and prices are also important. Hossain (1985) determined that there is greater variation in employment in crop production than in total employment, the coefficients of variation being 19 percent and 6 percent, respectively. There is greater variation in total wage employment (13 percent) than in self-employment (8 percent). There is not much difference in variation in nonagricultural wage employment (20 percent) and in agricultural wage employment (18 percent). The coefficient of variation is 19 percent in crop production, 17 percent in noncrop agricultural activities and 11 percent in nonagricultural activities.[3] Some studies have shown that

Table 5--Unemployed population, by duration of unemployment and sex, 1984-85

Duration of Unemployment	Bangladesh			Urban			Rural		
	Both	Male	Female	Both	Male	Female	Both	Male	Female
(weeks)					(percent)				
Less than 13	9.0	12.6	0.0	6.1	7.1	0.0	10.0	14.9	0.0
13-24	5.3	7.4	0.0	6.8	8.0	0.0	4.7	7.1	0.0
25-52	33.2	32.8	34.2	38.6	38.0	42.1	31.4	30.6	33.1
More than 52	51.8	47.2	63.2	48.5	46.9	57.9	52.9	47.4	63.9
Not reported	0.7	0.0	2.6	0.0	0.0	0.0	1.0	0.0	3.0

Source: BBS (Bangladesh Bureau of Statistics), Labor Force Survey, 1984-85 (Dhaka: BBS, 1988).

[3] These estimates are based on a year-long weekly survey of 140 preselected rural households in Dhaka and Dinajpur during 1981/82. Rahman and Islam (1988) find more variation in nonagricultural labor use than in agricultural labor use.

self-employment and nonagricultural employment provide seasonally complementary and stabilizing effects to agricultural wage employment (Hossain 1985; Rahman and Islam 1988; Muqtada 1975). However, other studies based on labor-time disposition surveys of poor households in rural areas of different parts of Bangladesh indicate no obvious pattern of countervailing use of labor time in nonagricultural activity during the slack period for agricultural employment (Parthasarathy 1989). The difficulties in labor absorption are found to reverberate throughout the employment structure and are not adequately offset by alternative employment opportunities. In any case, even in slack seasons, it may not be a question of unemployment, but one of low real wages due to low demand for labor (Ravallion 1987b).

Money Wages and Real Wages: Temporal Movements

How have money wages and real wages moved vis-à-vis the price of food in Bangladesh? The position has been examined for 1960-86/87. The time series of money wages, real wages, retail prices and the wage rate in kilograms of coarse rice are given in Table 6. The series of real wages and the wage rate in kilograms of coarse rice are also presented in Figure 1. The trend rates, derived by using a semilog function, are given at the bottom of Table 6.

During the period 1960-87, the price of coarse rice per kilogram has moved at a marginally higher rate than money wages, resulting in a slightly declining trend in the food wage rate (-0.20 percent per year). Real wages at 1973/74 prices have declined by -1.89 percent per year. However, the entire period comprises two subperiods, 1960-72/73 and 1973/74-86/87 (Figure 1): the first, a period of decline in real and food wages, and the latter, a period of improvement. The average real wage during 1973-87 at Tk 7.05 per day was lower than the level of Tk 9.06 per day at 1973/74 prices in the preceding period of 1960-73. Similarly, the average levels of the food wage rate were 2.52 and 2.72 kilograms in the recent and earlier periods.

Nominal Wages and Food Prices. How do nominal agricultural wages adjust to food price changes? The answer is cryptically provided by Ravallion (1987b):

> I will be surprised if anyone who has observed the movements over time of agricultural wages in South Asia would agree that food price increases were generally passed on fully in wages within say the current season. Shortrun stickiness in wages in both directions is a common feature of agricultural labor markets in South Asia and elsewhere.

Table 6--Wages and food prices

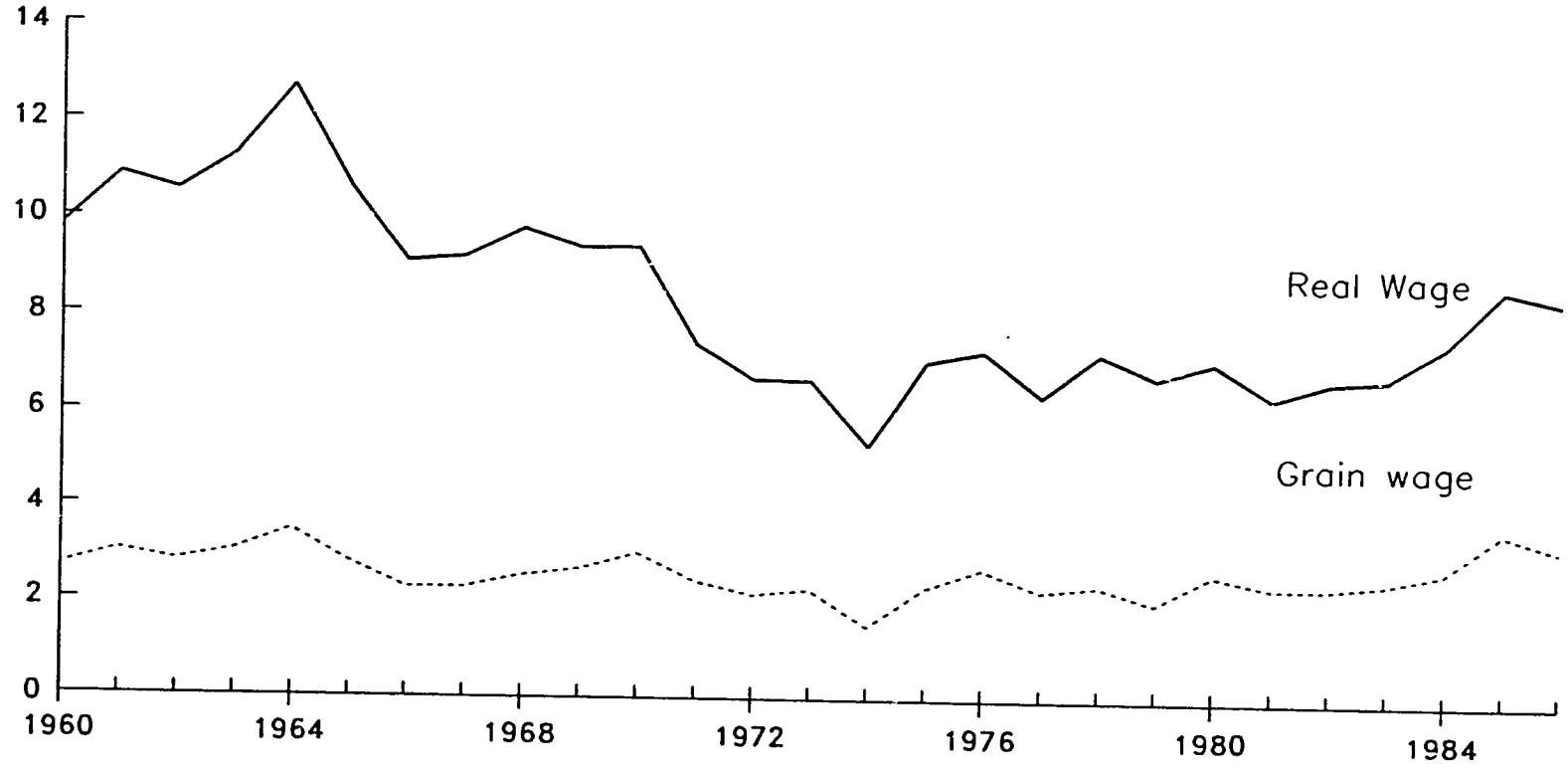
Year	Money Wages	Real Wages at 1973-74 Prices	Price of Coarse Rice/ Kilogram	Wage Rate in Kilograms of Coarse Rice
	(Taka per person per day)		(Taka per kg)	(Kg per day)
1960	1.95	9.83	0.72	2.71
1961	2.18	10.88	0.72	3.03
1962	2.25	10.55	0.79	2.83
1963	2.41	11.28	0.79	3.05
1964	2.65	12.72	0.76	3.49
1965	2.34	10.62	0.83	2.82
1966	2.4	9.1	1.05	2.29
1967	2.6	9.19	1.14	2.28
1968	2.75	9.78	1.08	2.55
1969/70	2.96	9.4	1.1	2.69
1970/71	3.13	9.42	1.03	3.03
1971/72	3.38	7.43	1.38	2.45
1972/73	4.72	6.71	2.18	2.17
1973/74	6.69	6.69	2.93	2.28
1974/75	9.05	5.33	5.97	1.52
1975/76	8.82	7.09	3.77	2.34
1976/77	8.93	7.32	3.25	2.75
1977/78	9.4	6.41	4.13	2.28
1978/79	10.88	7.28	4.53	2.41
1979/80	12.46	6.79	6.09	2.05
1980/81	13.98	7.12	5.23	2.67
1981/82	15.38	6.4	6.41	2.4
1982/83	17.05	6.76	7.09	2.41
1983/84	19.58	6 84	7.78	2.52
1984/85	24.45	7.55	8.83	2.77
1985/86	29.53	8.72	8.12	3.64
1986/87	32.92	8.46	10.05	3.28
Growth rate 1960-87	2.02	-1.89	12.26	-0.20

Sources: For 1960-80, A. R. Khan, "Real Wages of Agricultural Workers in Bangladesh," Review of Political Economy, Economic and Political Weekly, 19 (January 1984): 40-48. For 1981-87, BBS (Bangladesh Bureau of Statistics), Statistical Yearbook of Bangladesh (Dhaka: BBS, 1987).

Notes: The data from Khan were extended using wage rates and the averages of the consumer price index for rural families at Dhaka, Chittagong, Khulna, Rajshahi, Rangpur and Sylhet, from the Statistical Yearbook of Bangladesh. The retail prices of coarse rice from 1972/73-1986/87 are from the Ministry of Food, adjusted for the years before 1972/73 from Khan's work. The wage rate in kilograms of coarse rice is then derived as the money wage divided by the price of coarse rice.

To determine the responsiveness of nominal agricultural wages to changes in retail prices of coarse rice, consider the relationship of nominal agricultural wages at time t (WM_t) to nominal agricultural wages at time t-1 (WM_{t-1}), the retail price of coarse rice at time (t-1)(RP_{t-1}), and the time variable t. This function in double log form is fitted to the relevant data for 1960-86/87.

Figure 1--Real wage rate and wage rate in kilograms of coarse rice



Sources: Bangladesh Bureau of Statistics, Statistical Yearbook of Bangladesh 1987 (Dhaka, BBS, 1988); A.R. Khan, "Real Wages of Agricultural Workers in Bangladesh," Review of Political Economy, Economic and Political Weekly 19 (4) 1984; and Ministry of Food, unpublished data.

Note: The grain wage is derived from the nominal wage divided by the nominal price of coarse rice for each period.

$$\text{Log } WM_t = 0.325 + \underset{(7.99)^*}{0.781} \text{ Log } WM_{t-1} + \underset{(4.42)^*}{0.348} \text{ Log } RP_t - \underset{(0.82)}{0.083} \text{ Log } RP_{t-1} - \underset{(0.65)}{0.034} \text{ Log } t; \quad (1)$$

$R^2 = 0.99$, adjusted $R^2 = 0.99$, D.W. Statistic = 1.53.

The numbers in parentheses are t-values for the coefficients and an asterisk indicates significance at the 1 percent level. The equation shows that the wage responsiveness to the current retail price of coarse rice, although positive and significant, was only 0.35.

The above equation does not provide for any variables representing demand for labor. Accordingly, it was decided to incorporate the percentage of area under HYVs (TH_t) and the weighted average productivity of rice and jute per acre (rice and jute being the major crops) (PA) as alternative variables for demand for labor. The respective equations worked out for 1973/74-1986/87 are shown below:

$$\text{Log } WM_t = -0.144 + \underset{(2.0)^{***}}{0.450} \text{ Log } RP_{t-1} + \underset{(2.16)^{**}}{0.577} \text{ Log } LH_t + \underset{(1.54)}{0.155} \text{ Log } t; \quad (2)$$

$R^2 = 0.93$, adjusted $R^2 = 0.92$, D.W. Statistic = 1.00.

$$\text{Log } WM_t = -7.290 + \underset{(4.46)^*}{0.631} \text{ Log } RP_t + \underset{(3.75)^*}{3.303} \text{ Log } PA + \underset{(0.41)}{0.037} \text{ Log } t; \quad (3)$$

$R^2 = 0.96$, adjusted $R^2 = 0.95$, D.W. Statistic = 1.98.

The numbers in parentheses are t-values. The asterisks indicate significance at the 1(*), 5(**), and 10(***) percent level, respectively.

Both of these equations have good explanatory power with positive and significant responses of wages to the current retail price of rice, as well as to the labor demand variable. Although the response to the current price of rice is higher than in equation (1), it does not show complete neutralization even in equation (3) where the elasticity is 0.6. Labor demand, when represented by the weighted productivity of rice and jute per acre, has a considerable influence on nominal wages; a 1 percent change in productivity tends to be associated with a 3 percent change in nominal wages in the same direction. When area under HYVs is taken to represent the labor demand (incidentally, it may also be taken to be a proxy for technology), the elasticity of nominal wages is positive and significant and is equal to 0.6.

Real Wages, Production, and Prices

The supply of food in an economy is a major factor determining food prices, wages, and the demand for labor. When real wage levels are used to measure the extent of poverty in an economy, studies examining the relationship between poverty and production/prices become relevant. That growth of agricultural production tends to reduce the incidence of poverty, within the existing institutional system, has been shown by Ahluwalia (1977) on the basis of Indian data.[4]

Saith (1981) has argued that rural poverty is related directly to the consumer price index for agricultural laborers and inversely to agricultural production. Using the same data as Ahluwalia, Saith observes that the underlying trend term indicates a rising trend in rural poverty after accounting for the effects of the consumer price index and agricultural production. This is due to producer price policies, which may not permit the natural decline in prices consequent to growth in agricultural production.

Explaining movements in real wages is a complex problem. Whereas the supply of food determines real wages, it also determines food prices, which in turn affect real wages. It is also known that food prices can influence the supply of food. What is needed is therefore a full macromodel capturing the different interrelationships. This will be attempted later. In the immediate context, real wages (WR_t) are considered to be a function of the weighted average productivity of rice and jute per acre, the real retail price of coarse rice, deflated by the consumer price index number (RP_t), and trend The equation for 1973/74-1986/87 is as follows:

$$\text{Log } WR_t = 1.871 + \underset{(1.14)}{0.908} \text{ Log PA} - \underset{(1.42)}{0.500} \text{ Log } RP_t - \underset{(0.40)}{0.026} \text{ Log t}; \qquad (4)$$

$$R^2 = 0.61, \text{ adjusted } R^2 = 0.49, \text{ D.W. Statistic} = 1.67.$$

The equation explains 50 percent of the variation in real wages, but none of the variables is significant. As expected, an increase in productivity pushes up the real wages, while an increase in the real price of rice reduces the real wages. Elsewhere it has been shown that a decrease of 10 percent in the food price is likely to result in an increase of 6-8 percent in the real incomes of the poorest population deciles (Pinstrup-Anderson 1988).

Money wages and real wages have a positive relationship to productivity and technology. In a wage equation estimated on the basis of household data, Hossain (1988) finds the technology variable to be the dominant one affecting the wage rate. Also, the percent of

[4] More recently, the author has found that for India the simple correlation between the percentage of people below the poverty line and the index of agricultural production during 1960-83 was -0.5255, while that between the state growth rate of NDP from agriculture and the percentage of rural people below the poverty line was -0.3601 (Thamarajakshi 1989).

households living in poverty in "green revolution" villages is reported to be lower than in low-yield villages, with the bulk of this shift being in the chronic deficit households, that is, the agricultural labor households (BIDS 1990). A study on labor markets in Bangladesh shows that both employment and wage rates are higher in areas of high agricultural growth and in areas near an industrial center than in areas of low agricultural growth (Table 7) (Hiroshima and Muqtada 1986). On the basis of a survey of households in technologically developed and underdeveloped villages in 1982, Hossain (1988) finds that agricultural income for the landless was 73 percent higher in the former villages than in the latter villages, the difference due to agricultural wages alone being 79 percent (Table 8). Commenting on the employment gains consequent to the widespread adoption of the irrigation, seed, and fertilizer technology, Parthasarathy (1989) observes that there has been no conflict between growth and employment objectives in agriculture and points to evidence from studies showing that employment gains were higher for small farms than compared for large. Even hired labor gained under the new technology as the rate of growth of use of hired labor generally exceeded the family labor use. At the same time, Abdullah and Murshid (1986b) observe that "Although no firm conclusions could be generated, some evidence was found to support the view that the new technology could accentuate landlessness." In this connection, the authors refer to Bhaduri-type explanations of landlessness operating through share-tenancy and interlocked markets and hence emphasize land reform policies to stem landlessness without reducing the productivity gains achieved through technological change.

Seasonal Variations in Employment, Wages, and Prices

In Bangladesh, the aman crop is the leading foodgrain crop constituting 50 percent of cereal production, followed by boro (24 percent), aus (17 percent) and wheat (9 percent) (Government of

Table 7--Wage rates and average monthly agricultural employment in Bangladesh

Area	Average Daily Wage Rate		Average Monthly Employment of Hired Casual Workers in Crop Agriculture	
	Crop Activities	Noncrop Activities	Buy Season	Slack Season
	(Tk/day)		(man-days of 8 hours)	
Low agricultural growth	12.6	13.5	27.5	4.2
High agricultural growth	16.3	17.1	30.3	6.7
Near industrial centers	16.9	18.2	6.7	2.8

Source: M. Muqtada and M. Mustafa Alam, "Hired Labor and Rural Labor Market in Bangladesh" in Hired Labor and Rural Labor Market in Asia, ed. S. Hiroshima and M. Muqtada (Bangkok: Asian Regional Team for Employment Promotion/International Labor Organization, 1986).

Table 8--Estimates of household income in developed and underdeveloped villages, 1982

Income/Landownership Group[a]	Underdeveloped Villages	Developed Villages	Difference between Developed and Underdeveloped Villages
	(Tk/household)	(percent)	
Agricultural income			
Landless and marginal	3,708	8,000	116
	(3,549)	(6,151)	(73)
Small	9,201	11,234	22
Medium	16,190	20,685	28
Large	29,437	39,435	34
Nonagricultural income			
Landless and marginal	6,036	6,264	4
Small	6,819	7,071	4
Medium	8,119	7,618	-6
Large	9,372	16,721	78
Total Income			
Landless and marginal	9,743	14,264	46
	(9,585)	(12,415)	(30)
Small	16,020	18,305	14
Medium	24,309	28,303	16
Large	38,809	56,156	45

Source: Mahabub Hossain, Nature and Impact of the Green Revolution in Bangladesh, IFPRI Research Report 67 (Washington, D.C.: IFPRI in collaboration with BIDS, 1988).

Notes: Figures within parentheses are household incomes for the group, excluding the income from fishing. One of the villages under study has a high concentration of commercial fishermen, most of whom belong to the landless and marginal landowner group. This village is included in the developed area, so the high income of the landless from fishing in the developed villages may show a spuriously high positive impact of the new technology on the income for this group.

[a] Landless and marginal, less than 0.5 acre; small, 0.5 to 2.5 acres, medium, 2.5 to 5.0 acres; large, 5.0 acres or more.

Bangladesh 1990). Seasonal indices of employment, nominal wages, rice prices, and real wages, along with the share of monthly production of rice and wheat in total annual output, are given in the Table 9. In September/October, only about 2 percent of cereals is produced, and both rice and wheat prices are at their peak. Also in October, both employment and nominal wages are low. Rice prices have another peak in April and are at fairly high levels in March and May. The monthly flow of grain output in March is 1.8 percent and in April 3.1 percent. Althought there does not appear to be an employment constraint during March and April given the boro and aus crop operations, real wages are low compared with other months. Thus the months March, April, and October may be considered critical for households engaged in agricultural labor.

As a result of seasonal fluctuations in different types of employment for agricultural labor, in the price of food, and in wages, there are seasonal variations in consumption of cereals and in the

Table 9--Monthly production of rice and wheat, rice prices, employment, and wages

Month (1)	Percent of Monthly Production of Rice and Wheat to Annual Output (2)	Nominal Price Index of Coarse Rice (3)	Number of Fully Employed Workers* (4)	Nominal Rural Wage (5)	Real Agricultural Wage Index (6)
July	8.4	99.2	139	100.8	102.8
August	13.2	98.6	139	102.3	105.9
September	2.4	102.5	...	101.8	100.5
October	1.7	103.8	...	99.1	95.6
November	28.1	96.7	99	100.1	101.9
December	23.6	91.3	99	101.1	108.0
January	2.8	95.6	14	99.7	102.2
February	...	99.4	89	97.5	97.5
March	1.8	104.7	166	97.9	92.7
April	3.1	108.4	151	99.5	91.5
May	10.7	101.3	84	99.7	99.3
June	4.1	98.5	66	100.5	102.0
Highest Month	November	September/October March/April	March	August	December
Lowest Month	February	December	September/October	February	April

Sources and notes: Column (2): K.A.S. Murshid, "Micro-Level Adjustments to Foodgrain Shortages in Bangladesh," Bangladesh Development Studies (June 1987).
Column (3): Based on monthly prices from the Ministry of Food (average: 100).
Column (4): M. Muqtada, "The Seed Fertilizer Technology and Surplus Labor in Bangladesh Agriculture," Bangladesh Development Studies 3 (No. 4, 1975).
Column (5): Based on monthly nominal wage rates from the Bangladesh Bureau of Statistics (average: 100).
Column (6): The nominal wage deflated with the coarse rice price (average: 100).

* For 147 Dinatpur farms. Full employment is defined as 24 days of work per month.

nutritional status of rural laborers. In a 1976 study of Rangpur and Dhaka (INFS cited in Murshid 1987), the pre-aus season (June-July) and the pre-aman season (October-November) both show average daily per capita calorie consumption of less than 1,800 calories. During the post-aus (August) and post-aman (December-January) seasons, consumption was more than 2,000 calories. Similar results are reported by Clay (1981), who finds interregional variations as well as seasonal variations.

Interregional Variations in Agricultural Wages and Prices

District rates of agricultural wages (excluding food) were also examined. The coefficient of variation was about 20 percent for the triennium ending 1987/88. The interdistrict variations in money wages have to be considered along with interdistrict variations in prices. It is important to see how prices vary between seasons in different

districts. Two ways of examining this were tried: first, on the basis of seasonal indices of the price of coarse rice (1985/86 = 100) for each district, derived from the monthly average price for the particular district, and second, on the basis of maximum and minimum prices in different markets in different weeks for each district. The picture of variation that emerges from these two bases is quite different. The districtwise seasonal indices of the price of coarse rice were worked out on the basis of five years of data, 1985-90. Table 10 indicates the percentage differential between trough and peak indices. In general, the index reaches its lowest point in December and its highest point in April (in some cases, the peak is in March). The percentage variation between trough and peak ranges between 11 percent in Mymensingh/Noakhali to 21 percent in Tangail. The average variation is 15 percent, which is about the same as the observed variation on the basis of national indices of rice prices in different months. However, when the minimum and maximum of the coarse rice prices prevailing in different weeks in markets in different districts are examined, the minimum-maximum variation is seen to be of a much larger order than that observed on the basis of monthly indices. (Tables 11-14 give the prices for the four divisions of Bangladesh.) On average, the percentage variation ranges

Table 10--District peak-to-trough differentials in monthly indices of prices of coarse rice

District	Difference
	(percent)
Dinajpur	11.50
Rangpur	18.00
Bogra	16.52
Rajshahi	13.72
Pabna	15.66
Kushtia	17.42
Khulna	13.22
Jessore	16.62
Barisal	12.62
Patuakhali	14.34
Mymensingh	11.00
Jamalpur	19.67
Tangail	21.51
Faridpur	15.84
Dhaka	11.51
Sylhet	15.38
Comilla	13.85
Noakhali	10.98
Chittagong	13.54
Cox's Bazar	11.76
Rangamati	14.50

Source: Computed by the author from unpublished data.

Note: Estimated on the basis of seasonal indices of prices derived from districtwise data on monthly prices of coarse rice.

Table 11--Minimum and maximum prices of coarse rice across weeks and markets, Dhaka Division, 1987/88 and 1988/89

District	Minimum 1987/88	Maximum 1987/88	Minimum 1988/89	Maximum 1988/89	Difference between Minimum and Maximum 1987/88	Difference between Minimum and Maximum 1988/89
	(Tk/quintal)				(percent)	
Dhaka	880	1,150	840	1,250	30.68	48.80
Gazipur	835	1,175	900	1,175	40.71	30.55
Narayanganj	825	1,078	875	1,180	30.66	34.55
Narsindi	827	1,064	842	1,325	28.65	57.36
Munshiganj	850	1,100	840	1,125	29.41	33.92
Manikgonj	825	1,165	890	1,400	41.21	57.30
Faridpur	763	1,100	850	1,138	44.16	33.88
Madaripur	910	1,098	925	1,150	20.65	24.32
Rajbari	850	1,200	850	1,070	41.17	25.88
Gopalganj	860	1,250	900	1,100	45.34	22.22
Sariatpur	857	1,125	857	1,150	31.27	34.18
Tangail	828	1,150	852	1,280	38.88	50.23
Mymensingh	800	1,115	855	1,280	39.37	49.70
Netrokona	700	1,130	850	1,208	61.42	42.11
Kishoreganj	790	1,100	835	1,200	39.24	43.71
Jamalpur	760	1,071	820	1,248	40.92	52.19
Sherpur	828	1,048	829	1,300	26.57	56.81
Average	823	1,125	859	1,210	37.55	41.06
Standard deviation	48.10	50.93	27.92	85.33	8.97	11.61
Coefficient of variation	5.84	4.52	3.24	7.04	23.90	28.28

Source: Unpublished data from Bangladesh, Directorate of Agricultural Marketing.

Table 12--Minimum and maximum prices of coarse rice across weeks and markets, Chittagong Division, 1987/88 and 1988/89

District	Minimum 1987/88	Maximum 1987/88	Minimum 1988/89	Maximum 1988/89	Difference between Minimum and Maximum 1987/88	1988/89
	(Tk/quintal)				(percent)	
Sylhet	875	1,125	900	1,250	28.57	38.88
Moulovibazar	750	1,050	760	1,050	...	38.15
Hobiganz	800	1,050	800	1,100	31.25	37.5
Sunamgang	700	1,150	785	1,200	64.28	52.86
Comilla	880	1,070	900	1,200	21.59	33.33
B. Baria	790	1,100	850	1,100	39.24	29.41
Chandpur	800	1,021	805	1,180	27.62	46.58
Noakhali	850	1,100	900	1,130	29.41	25.55
Feni	850	1,070	900	1,205	25.88	33.88
Laxmipur	870	1,150	890	1,150	32.18	29.21
Chittagong	800	1,050	810	1,150	31.25	41.97
Cox's Bazar	800	1,100	820	1,100	37.5	34.14
Rangamati	850	1,100	875	1,100	29.41	25.71
Khagarachari	800	1,050	750	1,150	31.25	53.33
Bandarban	830	1,000	900	1,050	20.48	16.66
Average	816	1,079	843	1,141	32.66	35.81
Standard deviation	47.55	42.49	53.75	56.63	10.02	9.79
Coefficient of variation	5.82	3.93	6.37	4.96	30.68	27.36

Source: Unpublished data from Bangladesh, Directorate of Agricultural Marketing.

Table 13--Minimum and maximum prices of coarse rice across weeks and markets, Khulna Division, 1987/88 and 1988/89

District	Minimum 1987/88	Maximum 1987/88	Minimum 1988/89	Maximum 1988/89	Difference between Minimum and Maximum 1987/88	Difference between Minimum and Maximum 1988/89
	(Tk/quintal)				(percent)	
Jessore	755	1,050	775	1,200	39.07	54.83
Jinaidah	800	1,100	825	1,200	37.5	45.45
Magura	800	1,100	840	1,300	37.5	54.76
Narail	800	1,250	850	1,150	56.25	35.29
Khulna	810	1,035	850	1,125	27.77	32.35
Satkhira	825	1,025	850	1,050	24.24	23.52
Bagarhat	825	1,100	880	1,150	33.33	30.68
Kushtia	850	1,075	850	1,200	26.47	41.17
Chuadanga	800	1,100	800	1,250	36.5	56.25
Meherpur	800	1,100	800	1,200	37.5	50.0
Barisal	800	1,250	850	1,150	56.25	35.29
Perojpur	800	1,125	825	1,175	40.62	42.42
Jhalokathi	800	1,125	875	1,275	40.62	45.71
Bhola	825	1,150	840	1,125	39.39	33.92
Patuakhali	840	1,135	850	1,240	35.11	45.88
Barguna	800	1,103	850	1,200	37.87	41.17
Average	808	1,114	838	1,187	37.93	41.79
Standard deviation	20.98	61.16	26.62	60.64	8.44	9.19
Coefficient of variation	2.59	5.49	3.17	5.10	22.25	22.00

Source: Unpublished data from Bangladesh, Directorate of Agricultural Marketing.

Table 14--Minimum and maximum prices of coarse rice across weeks and markets, Rajshahi Division, 1987/88 and 1988/89

District	Minimum 1987/88	Maximum 1987/88	Minimum 1988/89	Maximum 1988/89	Difference between Minimum and Maximum 1987/88	1988/89
	(Tk/quintal)				(percent)	
Dinajpur	800	1,000	800	1,125	25	40.62
Thakurgaon	750	1,050	840	1,150	40	36.90
Panchagar	800	1,065	810	1,150	33.12	41.97
Rangpur	750	1,090	850	1,200	45.33	41.17
Nilphamari	777	991	790	1,252	27.54	58.48
Kurigram	750	1,018	830	1,370	35.73	65.06
Gaibanda	723	1,018	750	1,250	40.80	66.66
Lalmonirhat	777	1,071	790	1,200	37.83	51.89
Bogra	696	1,098	778	1,200	57.75	54.24
Joypurhat	750	1,071	776	1,252	42.80	61.34
Rajshahi	850	1,075	850	1,200	26.47	41.17
Noagaon	767	1,006	810	1,105	31.16	36.41
Natore	777	1,098	835	1,100	41.31	31.73
Nawabgonj	800	1,125	850	1,250	40.62	47.05
Pabna	803	1,098	850	1,200	36.73	41.17
Serajganj	750	1,072	830	1,232	42.93	48.43
Average	770	1,059	815	1,202	37.82	47.77
Standard deviation	35.38	39.51	30.63	66.09	7.94	10.40
Coefficient of variation	4.59	3.73	3.75	5.49	20.99	21.78

Source: Unpublished data from Bangladesh, Directorate of Agricultural Marketing.

between 3 percent in 1987/88 in Chittagong Division and 48 percent in Rajshahi Division in 1988/89. This evidence needs to be examined further, as the extent of the market integration in different parts of the country and seasons has important implications for agricultural labor given their migratory tendencies in slack seasons. Sahn (1989) was right when he remarked that "seasonalities vary from year to year, country to country, region to region, village to village, and household to household. This implies the need to decentralize policymaking and to develop and promote versatile responses to seasonal stress".

TARGETED AND UNTARGETED INTERVENTIONS

The government's targeted interventions--the Food for Work Programme (FFW) and the Vulnerable Group Development Programme (VGD)--have made significant progress. These two programs, which integrate food distribution with employment and skill development programs, have increased their share in the total Public Food Distribution System from 22 percent in 1981/82 to 49 percent in 1988/89, amounting to 1,400,000 metric tons in the later year. It has been reported that 150 million man-days of lean-season employment were generated through Food for Work for the rural poor in 1988/1989 at an average rate of 4.6 kilograms of wheat per day (World Food Programme 1989). However, in the case of VGD, 70 percent of the beneficiaries felt that the program provided an assured food supply, but only 3.4 percent thought that they received useful skill training or that there was much improvement in the effective provision of functional education (World Food Program 1989).

Table 15 shows the monthly percentage of offtake of wheat under FFW and VGD/TF programs in 1987/88. The bulk of FFW is concentrated in the period January-May, whereas most of the VGD distribution is during September-December. Regarding the effects of FFW on wages, the IFPRI/BIDS study (1985) reported that in 1981/82, workers received 4.2 kilograms of wheat per day per head, which was 26 percent lower than their legal entitlements. It appears that even in 1988/89, the average wage rate of 4.6 kilograms of wheat received by the FFW workers was considerably lower than the 5.8 kilograms of wheat that could be purchased under the prevailing wage rate for unskilled rural labor (World Food Program 1989).

Table 15--Monthly distribution of wheat offtake from Food for Work and Vulnerable Group Development programs, 1987-88

Month	Year	Food for Work	Vulnerable Group Development
		(percent)	
July	1987	0.48	4.94
August	1987	0.62	5.13
September	1987	1.54	14.29
October	1987	3.25	14.82
November	1987	2.68	16.72
December	1987	6.72	10.83
January	1988	15.14	8.47
February	1988	15.14	5.00
March	1988	21.07	4.80
April	1988	19.49	5.24
May	1988	12.05	4.97
June	1988	1.82	4.79

Source: Bangladesh, Ministry of Food, Food Planning and Monitoring Unit, Food Situation Reports (Dhaka: Ministry of Food, various months).

However, FFW seems to have helped somewhat in firming up wage rates. In the IFPRI-BIDS (1985) study of FFW, Hossain compares wage rates of agricultural workers in FFW project areas and those in control villages, demonstrating that the wage rates were higher in FFW villages (Table 16). Moreover, the employment effect of FFW was felt more in higher income of workers than in greater number of days employed, since FFW employment largely represented a shift from self-employment and, to a smaller extent, other forms of wage employment (Osmani and Chowdhury 1983; Islam 1985).[5] Also, since the daily remuneration from FFW is considerably higher than that from other sources, particularly compared with the marginal returns for self-employment, the effect measured in terms of income is highly significant. One available study (Parthasarathy 1989) shows that in 1984/85, in selected villages, employment from FFW varied between 2.02 percent and 9.52 percent of the total employment of poor households, the upper value being in a flood-prone village in Sylhet, which was more dependent on fishing than on agriculture. However, according to one estimate, the net income of Food for Work, that is, the income that would have accrued to the beneficiary in the absence of the program, is 55 percent, which means that only 36 percent of the total foodgrains disbursed represent the net benefit, assuming all payments were in kind (Osmani and Chowdhury, cited in Abdullah and Murshid 1986a).

Table 16--Wage rates of agricultural workers, in Food for Work villages and other villages, 1982

Type of workers	Project Villages	Control Villages	Both
Permanently hired		(Tk/month)	
Cash	125	103	114
Kind	240	238	239
Total	365	341	353
Casual workers		(Tk/day)	
Cash	5.27	3.87	4.51
Kind	12.88	12.16	12.53
Total	17.95	16.03	17.04
Labor-paddy ratio (kilograms of paddy needed to buy one day of labor)	4.45	4.01	
Marginal productivity of labor (Tk/day)	11.84	9.34	

Source: Mahabub Hossain, "The Effects of FFW in Agricultural Production" in IFPRI-BIDS Development Impact of Food for Work Programme in Bangladesh (Washington: IFPRI/BIDS, 1985).

[5] An IFPRI-BIDS study (1985) also concludes, on the basis of a limited finding that the use of hired labor by labor-hiring households would be reduced, that the employment effects of Food for Work would be lower than the actual estimated man-days created by Food for Work.

There have been suggestions for improvement of Food for Work. According to some, given the continued preference for rice, more rice should be distributed: Food for Work laborers sell part of their wheat for rice and in the process, suffer a monetary loss by getting a lower sale price than market price. It has also been suggested that Food for Work employment in different seasons should be dispersed more evenly. For this purpose, types of work that can be continuously carried out should be considered. Lastly, an index of distress/stress should be prepared with weights for regional and seasonal phenomena pertaining to production deficits, droughts and floods, nutritional deficiency, wage rates, and number of agricultural laborers.

Yet another channel of the Public Food Distribution System of recent origin that could be a potential instrument for transferring benefits to agricultural laborers is the rural rationing scheme. It purports to cover 2.4 million beneficiary families, who are mostly landless and near landless households, through a ration of 1.5 kilograms per head per week for each of three adult family members at a subsidized price of 25 percent. It may be expected that this explicit subsidy would increase the purchasing power of consumers and raise the demand for food, thereby changing producer prices and incentives (Pinstrup-Anderson 1988). In view of the income effects, the net price effect of rural rationing may be reduced. At the same time, since the food subsidy is related to food, an important wage good, it may depress wage rates to some extent. In the current year, the seasonal offtake was at its maximum in October (Table 17). It would be necessary to make seasonal allotments under the scheme in such a manner that it concentrates on the months in the first half of the year when Food for Work distribution is lean. It would also be necessary to dovetail a suitable employment intervention program with the rural rationing scheme to make it a productive channel of the public food distribution system.

It has already been shown that there are seasonal variations in consumption of cereals and nutritional status of rural laborers as a result of seasonal fluctuations in different types of employment for labor, in the price of food, and in wages.

> The immediate causes of a household's inability to acquire sufficient quantities of food during certain periods of the year revolve around a decline in real income (either cash or in kind) and an increase in market prices. These variations represent a threat to food security when either or both of two conditions hold: the household does not have the ability to save food stock or cash between seasons, and the pattern of seasonal variation is not predictable, thus introducing an element of risk into household savings and consumption behavior. (Sahn 1989)

Table 17.--Offtake under rural rationing (palli rationing), April 1989 through February 1990

Month	Year	Offtake	Percent
		(1,000 tons)	
April	1989	7.98	2.45
May	1989	17.31	5.32
June	1989	22.51	6.92
July	1989	28.69	8.82
August	1989	32.06	9.85
September	1989	33.62	10.33
October	1989	39.72	12.21
November	1989	36.90	11.34
December	1989	30.36	9.33
January	1990	38.72	11.90
February	1990	37.53	11.53
Total		325.44	100.00

Source: Unpublished data from the Directorate of Agricultural Marketing.

One important channel of the public food distribution system in Bangladesh that aims to reduce the seasonal price spread is open market sales by the government. In recent years, open market sales have constituted about 30 percent of the public distribution of rice and 7 percent of wheat. In open market sales, trigger prices are set at 15 percent above the procurement price in nonstatutory rationing areas and 20 percent in the statutory rationing areas (primarily urban). This margin between the minimum and maximum price should be adequate incentive to keep private trade in operation and also to keep prices reasonable for the vulnerable consumers. The effectiveness of open market sales in stabilizing prices, especially in rural areas, depends on (1) the number of centers in rural areas and the quantity of their sales; (2) an adequate number and quantity of sales centers and proper timing of sales; and (3) cross-flexibility of rice prices to wheat sales. With 270,000 tons of cereals, it is not clear that the rural-urban distribution across the 64 new districts would be enough to take care of the problem in rural areas. Much depends on the method of handling sales. These are handled through normal market channels, and it is up to these channels to further distribute the cereals in the market.

There seem to be structural limits to the extent and speed with which stabilization sales can help reduce seasonal food insecurity for the rural poor. As has already been shown, if weekly price data for various markets are taken through the years, the minimum-maximum differentials of rice prices are quite high. Market imperfections are likely to be greater in remote areas that have inadequate physical and social infrastructure; consequently, it is rural consumers who face greater fluctuations in market prices (Sahn 1989). A systematic study

is warranted to assess the effectiveness of open market sales for rural consumers, especially the rural laborers.

CONCLUSIONS

Whereas foodgrain prices are determined by food supplies and real incomes, the latter are influenced by changes in foodgrain prices. Both real wages and employment, which enter into real income determination, are affected by changes in agricultural production, technological growth, and institutional change. Policy interventions, both targeted and nontargeted, by the government in foodgrain markets influence foodgrain availability, prices, wages, and employment.

The trend rate of growth of cereal production has risen during 1971-85, compared with 1950-71, although some deceleration has been noted in the 1980s. On the aggregate, production has been lower than normative requirements. Fifteen out of 21 districts and 262-298 upazilas out of a total of 495 have been identified as deficit. Of the households that are chronically deficit on the basis of the minimum income levels needed to meet minimum cereal requirements, nearly 85 percent are landless or functionally landless. About 80 percent of 5.5 million agricultural labor households are in poverty. Studies have also reported an increase in the number of landless households.

The primary concern of most of these people is food--both the level and fluctuation of real food prices. Although half of the income of the bottom 50 percent of rural labor households is accrued as wage income, wage employment constitutes only 30 percent of total employment (agricultural and nonagricultural); the size of the rural labor market in this sense is limited.

Employment does not grow as fast as the labor force, and employment elasticities with respect to output are not very high, although there is not much open unemployment. The growth of food production has been unable to absorb the additional labor supplies, as a result of which landlessness has increased.

More important is the seasonal variation in demand for agricultural labor and associated fluctuations in wages due to seasonality in food production and prices. Employment in crop production is subject to greater variation than total employment. There are different views on the complementarity between agricultural and nonagricultural employment in slack seasons. However, even in slack seasons, the problem may not be unemployment as much as low real wages and productivity.

The long period 1960/61-1986/87 consists of two subperiods: 1960-1972/73, a period of decline in real wages and the food wage rate; and 1973/74-1986/87, a period of improvement. Even so, the average level of real wages, in constant 1973/74 prices, was lower in the latter period than in the former period. Empirical analysis shows that the elasticity of nominal wages to current prices of coarse rice is 0.6. Although this is not fully adjusted, it is higher than an estimate of 0.3 in the past

famine period. Nominal wages are also responsive to changes in agricultural productivity and foodgrain area under high-yielding varieties. Moreover, an increase in productivity pushes up real wages, whereas an increase in the real price of rice reduces real wages.

The positive influence of technological growth on the level of wages and employment has been brought out in some studies, although one view is that the new technology could accentuate landlessness.

An examination of monthly indices of nominal wages, real wages, employment, cereal prices, along with the percent of monthly production of cereals to total annual output, shows that the months March-April and October are critical for agricultural labor households from all points of view. These are also the months when rural consumption (daily calories per capita) is low.

Although an analysis of the extent of spatial integration of labor markets has been deferred in the study, it is seen that the coefficient of variation in districtwise money wages is 20 percent. This must be viewed in relation to interdistrict seasonal variation in cereal prices. The percentage variation in prices of cereals from trough to peak season ranges from 11 percent in Mymensingh/Noakhali to 21 percent in Tangail. However, if the prices prevailing in different weeks in different markets of the districts are taken into account, the minimum-maximum variation is of a much larger order than observed on the basis of smoothed monthly indices. This evidence needs to be examined further, as the extent of foodgrain market integration has important implications for agricultural labor given the tendency of labor to migrate in slack seasons.

FFW and VGD, the two targeted intervention programs that are directly relevant to employment and skills formation, have been considerably enlarged in scope over the years. Yet the employment generated under FFW in the lean seasons constitutes a small proportion of the total number of man-days available. Further, it appears that, even in 1988/89, the average amount of wheat received as wages by the FFW workers was significantly smaller than the quantity of wheat that could have been purchased with the prevailing wage rate for unskilled labor. However, there is evidence to show that FFW had positive effects on wages and marginal productivity. FFW increased incomes more than it increased the number of days of employment. The effects of VGD on skills formation has been insignificant to date.

For untargeted interventions, the potential assistance provided by two schemes--the rural rationing scheme for landless or near landless families and open market sales--has been examined. The rural rationing scheme is a new scheme, well-designed in terms of criteria; perhaps it would cover a considerable portion of the cereal intake deficit of these deprived households. However, what is important is the actual implementation of the scheme. It may be expected that the explicit subsidy in the scheme would increase the purchasing power of consumers and raise the demand for food, thereby changing producer prices and incentives. As a result of the income effects, the net price effect of rural rationing may be reduced. At the same time, since the subsidy is

related to food, an important wage good, it may depress the wage rate to some extent.

An important channel of public food distribution in Bangladesh is the open market sales by the government. It is aimed at reducing the seasonal spread of prices. The effectiveness of open market sales in stabilizing prices, especially in rural areas, depends on three conditions: the number of centers in rural areas and the quantities of sales; adequate number, quantity, and timing of sales; and the response of rice prices to wheat sales. Much depends on the *modus operandi* of these sales. There seem to be structural limits to how much and how fast stabilization sales can reduce seasonal food insecurity for the poor, given the infrastructural inadequacies of rural areas.

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3. RURAL WELFARE EFFECTS OF FOOD PRICE CHANGES UNDER INDUCED WAGE RESPONSES: THEORY AND EVIDENCE FOR BANGLADESH*

Martin Ravallion*

INTRODUCTION

The welfare effects in a food producing economy of changes in the price of food have been central issues in numerous debates on development policy.[1] The governments of many developing countries have used their control over external trade to hold domestic food prices below world prices. A commonly held view is that, while low food prices clearly benefit urban groups, the rural population who depend primarily on food agriculture are likely to be worse off. Against this view, it has been noted that, in many countries, the rural poor are actually net demanders of food; a great many of the poor in rural South Asia, for example, do not produce sufficient food for their own consumption, typically supplementing their own farm incomes with agricultural labor earnings. Under regular partial equilibrium conditions, such persons cannot benefit from high food prices.

This conclusion is contentious when other welfare relevant prices and quantities are responsive to changes in food prices. In particular, it has been argued that, by stimulating food production and the demand for agricultural labor, high food prices may benefit the rural poor through the induced wage response, even when the poor are net demanders of food; see, for example, Brown (1979), Tyagi (1979) and Lipton (1984).

But there has been little agreement on how responsive agricultural wages are to food prices. Contrast, for example, the recent views of Sah and Stiglitz (1987) with those of de Janvry and Subbarao (1984, 1986). Both pairs of authors aim to model the distributional effects of food pricing policies in economies in which the rural poor depend

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[1] An important debate has concerned the distributional effects of changes in the intersectoral terms of trade; contributions include Mitra (1977), Mellor (1978), Brown (1979), Tyagi (1979), Kahlon and Tyagi (1980), Lipton (1984), de Janvry and Subbarao (1984, 1986), and Sah and Stiglitz (1984, 1987). Related questions have arisen in recent research on famines in poor agrarian economies; see Sen (1981) and Ravallion (1987a, b). Also see the literature on the effects of food price changes on poverty measures including Saith (1981), Narains's work discussed in Mellor and Desai (1985), Besley and Kanbur (1988), and Ravallion and van de Walle (1988).

heavily on their earnings from supplying agricultural labor. Sah and Stiglitz contend it to be "plausible" that the food price elasticity of the agricultural wage rate is close to unity, implying that "... a movement in the terms of trade against (in favor of) agriculture hurts (helps) everyone in the sector, whether rich or poor" (p. 111).[2] On the other hand de Janvry and Subbarao (1984, 1986) assume that the nominal wage rate in agriculture is exogenously fixed, implying zero food price elasticity, and hence, quite adverse effects on the rural poor of higher food prices. Neither study presents any empirical evidence to support their assumptions.

This paper examines the rural welfare distributional effects of changes in food prices under induced wage responses for rural Bangladesh. The approach falls short of a fully fledged general equilibrium analysis of welfare effects with flexible prices; rather, attention is focused on the more tractable (and arguably most important) issue of the labor market responses to changes emanating from food markets. An effort is made here to base the analysis on a consistent model of farm-household behavior for which crucial parameters can be estimated with readily available data. The next section outlines the theoretical conditions for a vector of small price changes to be welfare improving for a stylized agricultural household. This permits identification of the critical value of the elasticity of the agricultural wage rate with respect to the price of food necessary for an increase in food price to be welfare improving. The critical value of that elasticity depends solely on variables which can be measured from any standard income-expenditure survey. The following section applies the theoretical results to available income-expenditure data and econometric estimates of the wage-price elasticity for Bangladesh and discusses the implications for the welfare distributional effects of foodgrain price changes. The final section offers some conclusions.

MARKETS AND PEASANT'S WELFARE

There can be little doubt that many poor households in rural areas of South Asia and elsewhere are highly vulnerable to at least the initial impact of an increase in the price of staple foods; indeed, a sizable proportion of the excess mortality observed during famines in this setting can be attributed to a short fall in the food purchasing power of incomes, associated with higher food prices (Ravallion 1987a, b). It is plausible that survival chance is the overriding determinant of individual welfare at such times; little else would seem to matter. But at other times, and for certain sorts of policy discussions, one may reasonably prefer to base the analysis on more familiar and (arguably) more general measures of economic welfare.

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[2] Though Sah and Stiglitz do consider other outcomes in which the food price elasticity of the agricultural wage is less than unity; see their Proposition 7 (p. 126).

Past discussions of the welfare effects of price changes have often focused on a single relative price or income, considered to be a good welfare indicator; a common example in this setting is the food purchasing power of the agricultural wage. However, it is well-known that, when more than one traded good is consumed, no single relative income or price variable will measure individual welfare changes exactly, and indeed, the errors involved in doing so may be large.

The welfare of a farm-household is measured here by the maximum utility the household can be presumed to attain under fairly regular assumptions about its preferences, own production processes, and the constraints imposed by the prices it faces in markets, and its endowments, including available time.[3] The model is general enough to encompass the constraints facing both "rich" and "poor" agricultural households. Within these constraints, the stylized farm-household is assumed to be free to choose the quantities relevant to its consumption, production, and labor supply decisions. All prices (including wage rates) are taken as given when making individual quantity choices. All households face the same prices, which do not vary according to whether one buys or sells the commodity in question.

The realism of some of these assumptions can be questioned. There is, for example, a widespread belief that involuntary unemployment exists in lean seasons in poor agrarian economies. Then some households will be quantity constrained in their labor supply decisions. Thus, the competitive model precludes one potentially important channel though which such households may benefit from higher food prices, namely through an increase in employment, at any given wage rate. It has also been claimed that wage rates vary according to whether one hires in or hires out labor, due to the existence of costs of transaction and supervision. There are numerous alternative behavioral assumptions that might be made here and the most realistic and yet consistent choice remains unclear. Nonetheless, the undistorted competitive model of the farm-household is at least an interesting starting point for investigating the welfare effects of price changes in this setting.

The agricultural household is assumed to hold continuous convex preferences over food consumption (x), consumption of other goods (y), and hours of leisure (L_1). Those preferences are represented by an increasing and strictly quasi-concave utility function $u(x, y, L_1)$. The maximization is constrained by the household's available time and a regular (convex) budget set, parametized by the prices of food and other goods (p and q respectively) and the agricultural wage rate (w). The budget constraint can be written as

$$px + qy + wH \leq wL_2 + pX + Z \qquad (1)$$

[3] For an introduction to agricultural household models of this type see Singh et al. (1986, Chapter 1).

where H is hired labor time, X is the food output from the household's own land, L_2 is household labor supply (time spent in outside employment valued at the same wage rate as H) and Z is any other potential source of consumption (such as nonfarm businesses, remittances, or dissaving). Own-output is assumed to be a strictly quasi-concave function of both landholding (h) and the total labor time devoted to own-production, comprising the farm-household's own time (L_3), plus any hired labor time from outside the household. Following common practice in this context, landholding is treated as an exogenously given nontraded good. On incorporating the household's time constraint, $L_1 + L_2 + L_3 = T$, and optimizing out labor inputs to own production, equation (1) implies that full expenditure is:

$$px + qy + wL_1 \leq Y \tag{2}$$

where

$$Y = wT + \pi(p, w, h) + Z \tag{3}$$

is the household's full income and π is the maximum profit from food production using the household's own land when labor input ($L_3 + H$) is optimal. (Note that the utility maximization problem is recursive: first $L_3 + H$ is chosen to maximize profit on own land, giving π, and then x, y, and L_1 are chosen to maximize utility subject to all prices (including w) and full income (including π)). The farm-household's welfare given these constraints is measured by the corresponding indirect utility function:

$$u = v(p, q, w, Y) \tag{4}$$

which is the maximum value of $u(x, y, L_1)$ with respect to x, y, and L_1, subject to (2).

Under such conditions it is well known that (to a first-order approximation) a vector of price changes (dp, dq, dw) will be welfare improving if and only if the induced change in income exceeds that of expenditure, holding all quantities constant; on applying the envelope theorem (Roy's identity) to the budget constraint (1), the necessary and sufficient condition for a welfare gain is that[4]

$$L_2dw + Xdp + dZ > xdp + ydq = Hdw \tag{5}$$

A complete analysis of the welfare effects of a food price change would require information in how nonfood prices and incomes as well as agricultural wages respond. It is not implausible (for example) that higher food prices would increase village level demand for the petty trading and service activities often supplied by the poor. Patrons may

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[4] This can be readily proved by taking the total differential of (4), noting that, by the envelope theorem, $\partial v/\partial p = -\lambda x$, $\partial v/\partial q = -\lambda y$, $\partial v/\partial w = -\lambda L_1$ (where $\lambda = \partial v/\partial Y$) and $\partial \pi/\partial p = X$, $\partial \pi/\partial w = -(H + L_3)$.

also become more generous to the poor.[5] In a relatively closed economy the prices of nonfood goods can also be expected to respond.

However, the following analysis will focus solely on the labor market responses to a food price increase. This restriction on the analysis is justifiable on two counts: it appears likely that the quantitatively most significant aspect of market responses would involve agricultural wages, and (more pragmatically) we have little or no data to guide empirical analysis of the effects on other (nonfood) prices and incomes.

The condition for a welfare gain after a small increase in the price of food, holding nonfood prices and incomes constant ($dq = dZ = 0$), can usefully be written in the following form:

$$du/dp \gtrless 0 \text{ as } p(X-x) + w(L_2-H)\eta = qy + (\eta-1)w(L_2-H) - Z \gtrless 0, \qquad (6)$$

where $\eta = pdw/(wdp)$ is the elasticity of the agricultural wage rate to the price of food. (Note that $X - x$ and $L_2 - H$ are the household's net supplies of food and labor respectively). Similarly, the monetary value to a farm household of a change in the food price is given by where λ denotes the marginal utility of full income.

$$du/\lambda = [p(X-x) + w(L_2-H)\eta]dp/p \qquad (7)$$

A number of remarks can be made about the conditions in (6):

(i) In the special case discussed by Sah and Stiglitz (1987, Proposition 7), an increase in food price will benefit all agricultural households (whether rich or poor) if η is sufficiently close to unity and $Z = 0$. This follows immediately from (6), noting that $qy > 0$.

(ii) For a farm household that is a net supplier of agricultural labor ($L_2 > H$), (6) can be used to derive the critical <u>minimum</u> level of the price elasticity of the wage rate necessary for the household to benefit from a food price increase. In particular

$$du/dp \gtrless 0 \text{ as } \eta \gtrless \eta^* \qquad (8)$$

where

$$\eta^* = p(x-X)/[w(L_2-H)] = 1 + (Z-qy)/[w(L_2-H)] \qquad (9)$$

is the ratio of food expenditure on markets to wage income. In words: the necessary and sufficient condition for an agricultural worker to benefit from a small increase in the price of food is that the elasticity of the wage rate to the price of food exceeds the ratio of the worker's net food expenditure (after deducting the value of own production) to labor earnings.

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[5] This need not be of negligible importance; for an analysis of the determinants of voluntary redistribution in a not dissimilar setting see Ravallion and Dearden (1988).

(iii) For a net employer of labor ($L_2 < H$), the second set of inequalities in (6) is reversed; η^* is then the maximum value of η consistent with a welfare gain from an increase in food price. Note also that $\eta^* > 1$ for $L_2 < H$ and small Z; values of η less than or equal to unity then imply that a price increase is welfare improving.

(iv) Under these conditions, the standard partial equilibrium result that a net supplier (demander) of a good will benefit (lose) from an increase in its price must be modified as follows. For any farm household that is a net demander of food and a net supplier of labor, the conditions in (ii) apply; the partial equilibrium result requires $\eta < \eta^*$. For a net supplier of food who is also a net demander of labor, the conditions in (iii) apply and so the partial equilibrium result requires $\eta > \eta^*$. If the household is either a net supplier of both food and labor or a net demander of both, then $\eta^* < 0$ and so the partial equilibrium result holds for all $\eta > 0$.

Nothing has been said yet about how η is determined. Following Sah and Stiglitz (1987) it can be assumed that the way wages respond to a change in food price is determined by the labor market clearing condition. Letting F(h) denote the distribution function for land, and assuming this to be continuous, the long-run market clearing wage rate (w^*) solves

$$\Psi(p,q,w^*) = \int_0^\infty L[p,q,w^*,W^* + \pi(p,w^*,h)]dF(h) = 0, \qquad (10)$$

where $L_2 - H = L(\bullet)$ is an individual farm household's net labor supply function and $\Psi(\bullet)$ is the corresponding aggregate excess supply function. The implicit wage rate solving (10) is:

$$w^* = w(p,q). \qquad (11)$$

The assumptions made so far are not strong enough to sign either of the slopes of this function. It is plain from (10) that the elasticity of w^* to p will be positive if (and, under the above assumptions, only if) $\Psi_p = \int(L_p + L_Y X)dF$ and $\Psi_w = \int[L_w + L_Y(L_3 + H)]dF$ have opposite signs. For η to not exceed unity, it is necessary and sufficient that $-p\Psi_p/(w\Psi_w) \leq 1$, and the elasticity is unity if this holds with equality.

EVIDENCE FOR BANGLADESH

The theoretical conditions derived above for signing the welfare effects of a price change are empirically testable using time series data on actual wage and price movements (to estimate η) and consumer income and expenditure surveys (to estimate η^*). This section brings together results from various sources to determine for Bangladesh the directions and magnitudes of the rural welfare effects of a change in the price of staple foodgrains under induced wage responses.

Boyce and Ravallion (1988) have estimated a dynamic econometric model of agricultural wage determination in Bangladesh over the period

1949-50 to 1980-81. The long-run equilibrium of their model can be interpreted as a log-linear approximation of equation (11). This was embedded within a short-run dynamic process that permits sluggishness in wage adjustment and lags in response to changes in the market clearing wage rate. The long-run agricultural wage rate was assumed to depend on the prices of rice (also interpreted as a proxy for other staple foodgrains), cloth and jute, the manufacturing sector wage rate, agricultural yields per acre, and a quadratic function of time. The long-run equilibrium was found to be homogeneous of degree zero in all nominal prices. The fitted model performed well by all diagnostic tests performed on its residuals (including Lagrange multiplier tests for residual autocorrelation, heteroscedascity, and normality). Checks were also made for simultaneity bias using an exogeneity test in which only the lagged values of wages and prices were included in the set of instrumental variables. Exogeneity was accepted. A model was also estimated in which the manufacturing wage rate was assumed to be influenced by the price variables, so as to pick up any further (indirect) effects of these variables on agricultural wage rates. The estimates obtained for both the short- and long-run elasticity of the agricultural wage rate to the price of rice were found to be highly robust to this change in model specification. The preferred model under the data consistent parameter restrictions is:[6]

$$\Delta w^a_t = \underset{(0.51)}{0.045} + \underset{(5.7)}{0.22}\,(p^r_t - p^c_t) + \underset{(8.6)}{0.47}\,(w^m_t - w^a_{t-1}) - \underset{(9.8)}{0.32}\,(w^m_{t-1} - p^c_t)$$

$$\underset{(2.9)}{-0.00037t^2} + \hat{v}_t \,, \qquad (12)$$

where w^a and w^m are the logs of the agricultural and manufacturing wage rates respectively, and p^r and p^c are the logs of the prices of rice and cloth respectively, and t is a time trend (expressed as the deviation from midpoint). The preferred estimates of the short-run (instantaneous) elasticity of the wage rate to the price of foodgrains is 0.22 (t = 5.7) and that for the long-run (steady state) elasticity is 0.47 (t = 5.0).

Following the arguments of Section 2, the welfare implications of these results will depend in part on whether the household is a net supplier of labor or net demander. One can identify the former group as the rural "poor" and the latter as the rural "rich." For Bangladesh, this stylization is plausible.

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[6] Absolute t-ratios are given in parentheses; $R^2 = 0.86$. Tests of the implicit parameter restrictions in the following regression as well as a wide range of residual diagnostics are given in Boyce and Ravallion (1988).

The results quoted above indicate that η is significantly less than unity, in both the short- and long-run; t-ratios for the null hypothesis $\eta = 1$ are 20.2 and 5.6 respectively. Thus all net employers of agricultural labor with negligible nonfarm income (Z) will unambiguously gain from an increase in the price of foodgrains.

For net suppliers of labor or net demanders with significant nonfarm income, the welfare effects of a change in foodgrain price depend crucially on both the expenditure share devoted to foodgrains and the income shares from agricultural labor and own-production of foodgrains. These can be estimated from standard income-expenditure surveys. The present discussion will be mainly based on results of the 1978-79 household expenditure survey for Bangladesh as reported in BBS (1984), although supplementary data from other sources will also be considered.

It is clear that, on average, nonfoodgrain expenditures (qy) dwarf nonfarm incomes (Z) in rural areas for all except the very poor households; see, for example, BBS (1984, Tables 15.18 and 15.28). Thus it can be safely assumed that $\eta^* > 1$ for net demanders of labor, and so they will unambiguously gain from an increase in the price of foodgrains.

The welfare effect on net suppliers of labor is more contentious. From BBS (1984, Table 15.28) one finds that the mean share of wages in income for the poorest 55 percent of rural households in 1978-79 was 0.48, although this varies a good deal according to income, falling sharply from 0.62 for the poorest households to 0.38 for the least poor households (Table 1). The same source gives estimates of imputed incomes from nonmarket activities for this group of households; this has a mean of 0.28 and, as can be seen from Table 1, varies little by income (0.24 to 0.30). "Business income" varies a good deal more, tending to increase with income (Table 1).

Further assumptions are necessary when interpreting the income decomposition data in Table 1. In particular, it is assumed that the "rural poor" are not only net labor suppliers, but also net demanders of food, i.e. they do not produce a positive marketable surplus. This is reasonable for Bangladesh. Thus the category "business income" should not include any income from the poor household's own-farm production, which will be found entirely under "imputed income."[7] Furthermore, one can assume that all imputed income is the value of foodgrain production.

Assumptions such as these are generally unavoidable when using the aggregated summary data typically available from income-expenditure surveys.[8] The categories used in the published results need not correspond exactly to the desired theoretical categories. However, the above assumptions appear to be reasonable. Casual observations suggest

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[7] The poor in a typical Bangladesh village are often involved in various small-scale business activities. These comprise the supply of various transport and domestic services and petty trading activities, such as collecting natural fuels and selling prepared beverages.

[8] One may be able to avoid these problems in future work with access to unit record data.

Table 1--Summary data and estimated welfare changes for rural poor, Bangladesh, 1978-79

Monthly Household Income (Taka)	Cumulative Percent of Households	Expenditure (percent of income)		Income by Source (percent)			η^* (percent)	Welfare Change of a 10 percent Price Increase	
		Food (total)	Food-grain	Wages	Business Income	Imputed Income		Short Run	Long Run
<300	8.7	70	46	62	11	24	35	-0.84	0.71
300-399	19	72	48	57	16	24	35	-1.1	0.28
400-499	31	72	47	48	21	27	42	-0.94	0.26
500-749	55	73	47	38	26	30	45	-0.86	0.09

Sources: Expenditure data are from BBS (1984, Table 15.25) and are given as a proportion of income, using the ratios of mean expenditure (BBS, 1984, Table 15.25) to mean income (BBS, 1984, Table 15.28). Income data are from BBS (1984, Table 15.28). Welfare changes are estimated using the fact that, from equation (7), the monetary value of the welfare effect (expressed as a percentage of income) of a 10 percent foodgrain price increase is given by

$$10 \times \left[\begin{array}{c} \text{income share} \\ \text{from foodgrain} \\ \text{production} \end{array} - \begin{array}{c} \text{income share on} \\ \text{foodgrain} \\ \text{consumption} \end{array} + \begin{array}{c} \text{wage rate elasticity} \\ \text{w.r.t. foodgrain} \\ \text{price} \end{array} \times \begin{array}{c} \text{income share} \\ \text{from wage} \\ \text{labor} \end{array} \right]$$

that business income for the rural poor in Bangladesh is largely obtained from nonagricultural cottage industries and services. And the implied estimate of 0.28 for mean farm income of the poor accords well with at least one independent survey: at a similar time, Osmani and Chowdhury (1983) obtained a mean of 0.27 for the production of income from agriculture in a sample of about 500 poor rural households in Bangladesh. Probably a small proportion of the imputed income from own-production is not from foodgrains; most peasants in Bangladesh typically devote a small amount of land to vegetables to be consumed at home. Thus, the assumption that all imputed income is from foodgrain production probably leads to underestimation of η^*.

Nor is the available data ideal on the expenditure side. BBS (1984, Table 15.18) gives a figure of about 0.75 for the share of expenditure going to food by the rural poor, and this shows negligible variation according to income amongst the poorest half of the income distribution. BBS (1984) does not, however, give a more detailed breakdown of food expenditure. For an earlier (1973-74) survey, BBS (1980, Table 4.12) does give more detail. An Engel curve was calibrated to the earlier data and used to estimate expenditure shares devoted to

staple foodgrains during 1978-79, assuming a stable demand function.[9] The estimated foodgrain share of expenditure for the poorest half of the rural population is approximately 50 percent and this varies little with income. As a proportion of income the mean is 0.47.

Combining these assumptions and sources, it appears that two of the three figures necessary for calculating η^* can be estimated with considerable precision, while the third (the income share from wage labor) appears to be rather more variable amongst the poor. The implications of this will be considered later. As the mean points, the above sources indicate a value of $\eta^* = 0.43$ for the rural poor, again defined as the poorest 55 percent of households according to household income.

On the basis of these results it is plausible that the rural poor will typically be worse off in the short run after an increase in the price of food staples. Boyce and Ravallion's point estimate for short-run η of 0.22 is well below the above estimates of η^* and, indeed, the latter are also outside the Boyce and Ravallion 95 percent confidence interval for short-run η of (0.14, 0.30).

The long-run effect is less clear. At mean points, the above estimate of η^* is negligibly different from the Boyce and Ravallion estimate for long-run η^* ($\eta - \eta^* = 0.04$). It appears then that the welfare of poor households would typically be fairly unresponsive to the price of foodgrains in the long run.

The significance of differences in welfare effects <u>amongst</u> the poor should not, however, be underrated. It is not obvious on a priori grounds how the direction of the welfare effect will vary according to income. In Bangladesh (as elsewhere in South Asia), poorest households in rural areas tend to have access to the least amount of land.[10] To a first-order approximation in partial equilibrium, the welfare loss (as a proportion of income) from a food price increase will be directly proportional to the household's excess demand for food (as a proportion of income), which will tend to be greater for the poorest households. More generally, the welfare loss will be mitigated by the response of wages, and, as noted earlier, the share of income from wage labor tends to increase as income falls. From Table 1 it can be seen that the rate at which imputed income from own production falls with income amongst the poor is modest compared with the rate at which the wage share of

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[9] The following Engel curve was calibrated to 1973-74 data (from BBS, 1980, Table 4.11) for 11 expenditure groups (the top two were excluded to give more precise estimates for lower income groups):

$$\hat{S} = \underset{(5.5)}{0.33} + \underset{(6.0)}{0.14}\ln E - \underset{(6.7)}{0.015}(\ln E)^2, \qquad R^2 = 0.90,$$

where S = share of total food expenditure devoted to foodgrains, E = mean monthly expenditure on all foods, and absolute t-ratios are given in parentheses. Mean food expenditures by income group for 1978-79 were deflated to 1973-74 prices for use in the above formula.

[10] See, for example, Ravallion (1989).

income rises as income falls. Thus, on balance, the value of η^* tends to vary positively with income, as can be seen in Table 1. It follows that (in contrast to the partial equilibrium result) the long-run welfare effect of a foodgrain price increase is more likely to be positive for the poorest households.

Table 1 brings together these considerations to enable estimates of the monetary values of the welfare changes due to foodgrain price increase for the rural poor. The calculations are done for a 10 percent increase in the price of foodgrains, and the results are expressed as percentages of total income. The monetary value of the short-run welfare loss from such a price increase represents about 1 percent of income amongst the poor. In the long-run, the poorest group gains the equivalent of slightly less than three-quarters of 1 percent of income while the gain to the least poor group is negligible.

Since the short-run and long-run effects of an increase in foodgrain prices on welfare of the rural poor are in opposite directions, it is also of interest to ask: how long will it take for the welfare effect to change sign? From the results of Boyce and Ravallion (1988, equation 14) one can calculate that the elasticity of the wage rate to a foodgrain price reaches a value that is negligibly different from the mean η^* of 0.43 by the fourth year after the price increase. A typical poor person would not start to gain from the price increase before this time. The time taken for the welfare effect to change direction also varies amongst the poor; for the poorest group in Table 1, η is negligibly different from η^* by the second year, while for the highest income group amongst the poor, the switch point is not reached until early in the fifth year after the price increase.

CONCLUSIONS

Empirical results on the dynamics of wage formation in Bangladesh suggest that an increase in the price of rice is very unlikely to be passed on in the agricultural wage rate, even in the long run (Boyce and Ravallion 1988). The results of this paper suggest that, with induced wage responses, it is likely that the short-run distributional effects on rural welfare in Bangladesh tend to be in the same direction as those implied by partial equilibrium analysis: the rural rich are likely to gain and the rural poor lose from an increase in the relative price of food staples. This is also likely to be the case in steady state equilibrium for the rural rich, but the welfare of a typical poor household is more likely to be neutral to the price of rice in the long run. The long run welfare effect will, however, vary amongst the poor and (contrary to intuitions based on partial equilibrium analyses that ignore wage responses) the effect on welfare of a price increase appears more likely to be positive for the poorest households than for those who are less poor. It would typically take three or four years before a rice price increase ceased to have an adverse effect on welfare of the rural poor.

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