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Change in relative food prices is, in the short run, one of the most important determinants of change in the relative and absolute real income of low-income people. They spend a high proportion of their income on food and depend directly or indirectly on agriculture for a high proportion of their employment and income. In the longer run, food price policy may affect shifts in the supply function for wage goods and thereby influence the extent to which total wage employment and hence income of the laboring classes can be expanded.

Thus, there are important trade-offs and conflicts among various direct short-run influences and indirect long-run effects of price policy on the real incomes of the poor. Similarly, if the aggregate supply of food is fixed, there are direct income trade-offs for low-income families between change in prices and change in employment as market devices for providing the equilibrium consumption level.

Because the interrelationship among price, supply of wage goods, pattern of production, and income distribution are so complex, only a general equilibrium analysis can unequivocably determine the various effects of specific food price policies on income distribution. In contrast, the substantial literature on agricultural price policy is dominated by analysis of the partial relation between relative agricultural prices and production. Further, economists have not only concentrated their analyses of agricultural prices on production relations rather than on distributional effects but have given least attention to those aspects of production, such as marketable surplus, risk-uncertainty relationships, and shift of resources among enterprises of varying labor intensity, which

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are most relevant to the absolute and relative incomes of low-income consumers and producers.[1]

The purpose of this paper is to delineate the component parts of a general equilibrium analysis relevant to the relation of price policy to income distribution; to present data as to the relation of price change to a variety of those component parts; and to suggest the nature of the various interactions among those parts. The presentation commences with the more standard, relatively simple, and very limited questions of price influence on income distribution and provides the empirical basis for answers to those questions. It then proceeds to successively more complex questions, indicating the bases for judgments on those matters, but falling increasingly short of a definitive position.

Perhaps the most straightforward question about prices and income distribution is, given that all other influences are constant, what is the effect of a change in relative food prices on the absolute and relative levels of income of various consumer income classes? Part I explores that question first by using consumer budget data to estimate the income effect of a change in grain prices on income, on grain consumption, and on consumption of other goods for various income classes. The possible secondary effects of those same changes in consumption patterns on employment are noted, and the modifying influence of substitution effects is discussed. Finally, the analysis is broadened to show through the same consumer budget data the effect of a change in supply

[1] The complexity of the issues and the weight of analysis toward narrow short-run production considerations is reflected in the differences and controversy in the following: M. L. Dantwala, "Incentives and Disincentives in Indian Agriculture," *Indian Journal of Agricultural Economics* 22 (April–June 1967): 1–25; V. M. Dandekar, "Agricultural Price Policy," *Economic and Political Weekly* 3 (March 16, 1968): 454–59; John W. Mellor, "The Functions of Agricultural Prices in Economic Development," *Indian Journal of Agricultural Economics* 23 (January–March 1968): 23–37; John W. Mellor, "Agricultural Price Policy in the Context of Economic Development," *American Journal of Agricultural Economics* 51 (December 1969): 1413–20; Uma J. Lele, "Agricultural Price Policy," *Economic and Political Weekly* 4 (August 1969): 1413–19; Uma J. Lele, *Food Grain Marketing in India* (Ithaca, N.Y.: Cornell University Press, 1971); Uma Lele, "Considerations Related to Optimum Pricing and Marketing Strategies in Rural Development," 16th International Conference of Agricultural Economists, Nairobi, Kenya, July 26–August 4, 1976; Raj Krishna, "Agricultural Price Policy and Economic Development," in *Agricultural Development and Economic Growth*, ed. Herman H Southworth and Bruce Johnston (Ithaca, N.Y.: Cornell University Press, 1968); Theodore W. Schultz, *Transforming Traditional Agriculture*, Studies in Comparative Economics no. 3 (New Haven, Conn.: Yale University Press, 1954); E. S. Mason, *Economic Development in India and Pakistan* (Cambridge, Mass.: Center for International Affairs, Harvard University, 1966). For an effort to look directly at the effects of agricultural price changes on income of various socioeconomic classes, see Roberto Echeverria, *The Effect of Agricultural Price Policy on Intersectoral Income Transfers*, Occasional Paper no. 30 (Ithaca, N.Y.: Department of Agricultural Economics, Cornell University–USAID Employment and Income Distribution Project, June 1970).

of foodgrains on the real income of various consumer classes. Note is made of the effect of various simplifying assumptions.

Part II shifts to the distributional effects of price changes on producers of different income classes. The analysis commences with the simpler but generally less relevant case—a change in price with no change in production. Data for various farm-income classes are used to analyze this effect. The analysis is then broadened to explore the effect of concurrent changes in production and prices, with alternative assumptions about demand elasticities.

Part III takes up the far more complex question of the effect of prices on agricultural production, first in the context of static technology, and then in the more relevant but less understood context of technological change. The production effects are, of course, relevant to income distribution because of the constraint which the supply of wage goods may provide to growth in en ployment of low-income people. This part of the analysis serves to bring together the very limited literature on the relation between various aspects of price policy and technological change in agricultural production.

Part IV briefly presents a number of considerations relating food prices to employment in the agricultural and nonagricultural sectors. The discussion, on a subject of as great importance as that in earlier parts, reflects the extreme thinness of conceptual and empirical work in this area. The discussion serves to underline once again the complexity of the considerations underlying an optimal food price policy and the weak data base for improving such decisions.

Part V summarizes major policy implications which may be drawn from the various partial analyses.

I. Direct Effects of Foodgrain Price Change on Distribution of Income among Consumers

Change in foodgrain prices causes a larger percentage change in the real incomes of low-income consumers, but a larger absolute change in the real incomes of high-income consumers. The absolute effect on the incomes of high-income consumers may have secondary effects on the poor through changes in consumption of other goods and services and a consequent change in employment in their production.

Thus, in India, the top 5% in the income distribution spends over two and a half times as much per capita on foodgrains as the lowest two deciles in the income distribution (table 1).[2] However, despite its large absolute expenditure, this upper-income class allocates only 15%

[2] In India, foodgrains represent a major portion of total expenditure and exhibit sharply different marginal propensities to consume across income classes. The same analysis is relevant to countries with higher incomes than India if the subset of food items is defined sufficiently more broadly than foodgrains as to maintain these two characteristics.

of its total expenditure to foodgrains, compared with 54% for the lower-income class (calculated from table 1).

Table 2 presents data as to the income effect of an increase in foodgrain price. For high-income nations, this effect is normally considered negligible; but it is a major factor in low-income nations, where the proportion of family income spent on foodgrains is much higher. The analysis uses Indian data because of its availability, because foodgrains are dominant in Indian consumption patterns, and because of the low levels of income. After analysis of the income effect, alternative assumptions with respect to substitution effects will be discussed. The income effect of a price change is analyzed by using cross-section data, collected by the National Council of Applied Economic Research from a large sample of Indian households, to compare initial expenditure patterns with those of the different total expenditure classes entered as a result of changes in real income due to changes in foodgrain prices.

For the data presented, if foodgrain prices rise by 10%, the lowest two deciles in expenditure, which initially spend Rs 4.830 per capita per month on foodgrains, experience a real total expenditure decline of Rs 0.494 per capita per month (table 2). The decline in total real expenditure is, in fact, slightly greater than 10% of the initial expenditure on foodgrains because the proportion of total income spent on foodgrains increases in successively lower income classes. In this case, assuming all other prices as well as the proportion of income saved as constant and expressed in constant price terms, the new real expenditure will be Rs 8.44 per capita per month, or a decline of 5.5%.

In contrast, the top 5% in the expenditure distribution experiences a decline in real total expenditure of Rs 1.01 or somewhat over twice as large an absolute decline as that of the lower-income class; but at only 1.2% of the initial expenditure, there is less than one-quarter as large a percentage decline as that experienced by the lower-income class. The expenditures of the poor on foodgrains are, of course, far more elastic with respect to the income effects of price than are those of the rich. For the bottom two deciles in the income distribution, the elasticity of response of real expenditure (assuming no substitution effect) to change in foodgrain prices is 0.55, compared with 0.12 for the top 5% (table 2).

A number of other relationships important to income distribution are illuminated by this exercise. It is significant that in response to a price increase both the absolute and the percentage decline in real expenditure on foodgrains is greater the lower the income class. Thus, for a 10% increase in foodgrain prices, the bottom two deciles reduce their real expenditure on foodgrains by 5.9%, compared with a reduction of only 0.2% by the upper half of the tenth decile (calculated from tables 1 and 2). More important, this top income class reduces its absolute

TABLE 1

PER CAPITA MONTHLY EXPENDITURE, BY EXPENDITURE CATEGORIES AND CLASSES, INDIA, 1964–65
(Rs)

	Bottom Two Deciles	Decile 3	Deciles 4 and 5	Deciles 6, 7, and 8	Decile 9	Lower ½ of Decile 10	Upper ½ of Decile 10	Mean for All Classes
Per capita monthly consumer expenditure	8.93	13.14	17.80	24.13	30.71	41.89	85.84	24.43
Monthly per capita expenditure on:								
Foodgrains	4.83	6.84	8.31	9.58	10.45	11.37	12.80	9.68
Milk and milk products	.19	.58	1.13	1.94	2.79	4.15	8.58	1.98
Meat, eggs, and fish	.10	.22	.36	.56	.76	1.08	2.20	.57
Other foods	1.19	1.34	1.64	2.16	2.78	3.98	10.16	2.19
Tobacco	.19	.25	.32	.39	.47	.59	1.00	.40
Vanaspati	.01	.04	.11	.23	.36	.59	1.25	.23
Other oils	.14	.34	.56	.81	1.02	1.28	1.84	.82
Sweeteners	.16	.36	.58	.85	1.08	1.40	2.17	.86
Cotton textiles	.47	.84	1.20	1.64	2.04	2.63	4.34	1.66
Woolen textiles	*	.01	.03	.06	.11	.20	.79	.06
Other textiles	*	.01	.01	.02	.04	.09	.66	.02
Footwear	*	.06	.10	.15	.21	.30	.59	.16
Durables and semidurables	.07	.11	.17	.27	.40	.68	2.45	.28
Conveyance	.04	.09	.16	.30	.49	.94	4.12	.30
Consumer services	.11	.19	.30	.48	.68	1.09	3.19	.48
Education	.04	.08	.15	.29	.49	.94	4.23	.30
Fuel and light	.57	.89	1.19	1.56	1.89	2.37	3.82	1.57
House rent	*	.02	.05	.15	.30	.69	3.38	.15
Miscellaneous (approx.)	.82	.87	1.43	2.71	4.35	7.52	18.17	2.72

SOURCE.—The data source is the National Council of Applied Economic Research, *All-India Consumer Expenditure Survey*, vol. 2 (New Delhi: NCAER, 1967). These data provide expenditure elasticities of foodgrains and milk and milk products consistent with those from the *National Sample Survey* (*NSS*) of 1963–64 when fitted to the function used here. R^2 for equations estimated from grouped data for different commodities varied between .742 and .981. The NCAER data provide more detailed breakdown of expenditure than the *NSS*, but for a sample biased toward higher-income groups. The mathematical functional form used for these calculations was: $\log y = a + b/x + c \log x$ where y = per capita monthly expenditure on a commodity in each expenditure class x and x = per capita monthly total expenditure in each expenditure class. For a more complete discussion of the data, see B. M. Desai, *Analysis of Consumption Expenditure Patterns in India*, Occasional Paper no. 54 (Ithaca, N.Y.: Department of Agricultural Economics, Cornell University–USAID Employment and Income Distribution Project, August 1972).

* Negligible.

TABLE 2

DECLINE IN EXPENDITURE CONSEQUENT TO THE INCOME EFFECT OF A 10% RISE IN THE PRICE OF FOODGRAINS, BY EXPENDITURE CATEGORIES AND CLASSES, INDIA, 1964–65*
(Rs)

EXPENDITURE CATEGORY	EXPENDITURE CLASS							
	Bottom Two Deciles	Decile 3	Deciles 4 and 5	Deciles 6, 7, and 8	Decile 9	Lower ½ of Decile 10	Upper ½ of Decile 10	Mean for All Classes
Initial total per capita monthly expenditure	8.93	13.14	17.8	24.13	30.71	41.89	85.84	24.43
Decline in monthly per capita expenditure due to the income effect of a 10% rise in foodgrain price:								
Foodgrains	.285	.260	.208	.153	.115	.068	.026	.147
Milk and milk products	.034	.074	.105	.125	.196	.132	.113	.124
Meat, eggs, and fish	.013	.021	.026	.03	.031	.032	.030	.030
Other foods	.004	.037	.061	.085	.104	.131	.210	.085
Tobacco	.008	.010	.011	.012	.012	.012	.011	.012
Vanaspati	.003	.008	.013	.020	.022	.022	.015	.019
Other oils	.020	.033	.037	.340	.030	.023	.010	.034
Sweeteners	.022	.034	.038	.038	.034	.028	.006	.037
Cotton textiles	.043	.057	.062	.062	.058	.055	.042	.062
Woolen textiles	†	.002	.004	.006	.003	.011	.021	.006
Other textiles	†	.001	.001	.002	.003	.006	.033	.002
Footwear	†	.006	.007	.008	.009	.008	.008	.008
Durables and semidurables	.004	.007	.012	.017	.023	.032	.067	.017
Conveyance	.004	.010	.015	.025	.034	.052	.062	.024
Consumer services	.009	.015	.021	.029	.035	.044	.072	.028
Education	.005	.009	.015	.025	.035	.054	.135	.025
Fuel and light	.040	.049	.051	.051	.050	.052	.036	.05
House rent	†	.005	.009	.019	.029	.046	.101	.018
Absolute decline in total expenditure	.494	.638	.696	.741	.772	.808	1.01	.728
Decline in total expenditure (%)	5.53	4.86	3.91	3.07	2.51	1.93	1.18	2.98

SOURCE.—For data source and mathematical function used, see table 1.

NOTE.—Let the demand function for the ith commodity be

$$Q_i = Q_i(P_i, \ldots, P_i, \ldots, P_n, Y) , \tag{1}$$

where P_i = price of the ith commodity; $i = 1, \ldots, N$; and Y = total expenditure. The effect of change in the price of ith commodity on the demand for any commodity, say jth, is given by the Slutsky equation as follows:

$$\frac{\partial Q_i}{\partial P_i} = \left(\frac{\partial Q_i}{\partial P_i}\right) \text{utility} = \text{constant} - Q_i \left(\frac{\partial Q_j}{\partial Y}\right) \text{prices} = \text{constant} . \tag{2}$$

This can be written as

$$\frac{\partial P_j Q_j}{\partial P_i} = \left(\frac{\partial P_j Q_j}{\partial P_i}\right) \text{utility} = \text{constant} - Q_i \left(\frac{\partial P_j Q_j}{\partial Y}\right) \text{prices} = \text{constant} . \tag{3}$$

In terms of elasticity, eq. (3) can be written as:

$$E_{ji} = c_{ji} - b_i \eta_j , \tag{4}$$

where E_{ji} = uncompensated price elasticity of demand for jth commodity with respect to the price of ith commodity, c_{ji} = compensated price elasticity of demand for jth commodity with respect to the price of ith commodity, b_i = budget share of ith commodity, and η_j = expenditure elasticity of jth commodity. We further know that

$$\sum_{i=1}^{n} c_{ji} = o \text{ and } c_{ji} = c_{ij} \tag{5}$$

for all i and j. Thus, if the ith commodity is foodgrains, then the assumption that all the cross price elasticities are zero would imply that

$$c_{ji} = 0 \tag{6}$$

for all j and i whenever either the jth or ith commodity is foodgrains. Substituting eq. (6) into eq. (4) we get

$$E_{ji} = -b_i \eta_j \tag{7}$$

for all j. Alternatively, the change in consumer expenditure on the jth commodity as a result of a 10% change in foodgrain prices is given by the product of the expenditure on the jth commodity, the expenditure elasticity of the jth commodity, the proportion of expenditure on foodgrains, and the proportionate change in foodgrain prices.

* Assumes no change in the percentage saved.

† Negligible.

real expenditure on foodgrains by only Rs 0.03, compared with over 10 times as large an adjustment by the lower-income class (table 2). These data illustrate that in a market economy the bulk of adjustment to reduced supplies of foodgrains is made by low-income consumers.[3] Given the low initial level of foodgrain consumption in the lower-income deciles, the privation imposed on them by rising grain prices is very great. But any measures which seek to insulate the poor from the necessity to adjust to reduced supplies will force the need for adjustment to those whose demand is much more inelastic—thereby causing proportionately much greater, and perhaps explosive, price increases. It is clear from this analysis that it is essentially impossible to protect the poor from the major income effects of a short crop by market measures.

Further adverse consequence for the poor of a change in relative foodgrain prices may follow from the effects of such a change on the consumption of other commodities. As a result of a rise in foodgrain prices, the absolute decline in expenditure for almost all nonfoodgrain commodities is greater for higher-income classes than for lower-income classes, although of course the percentage decline in expenditure is much greater in each case for the lower-income classes. For example, in response to a 10% increase in foodgrain prices, the lowest two deciles in the income distribution reduce consumption of milk and milk products by 33%, compared with a reduction of 9% by the top 5%, though the absolute reduction by the higher-income class is over three times as great as for the lower-income class (tables 2 and 3). Overall, while foodgrain consumption declines only 4%, consumption of most other commodities declines between 10% and 30% (calculated from table 3).

These relationships suggest, first, that an increase in foodgrain prices may lead to substantially reduced consumption by the poor of agricultural commodities of high nutritive value. It is, of course, conceivable, but neither logical nor likely, that the poor would respond to increased foodgrain prices by some substitution of higher-quality foods which, though more expensive, had not increased in price.

Second, the large absolute reduction in consumption by higher-income groups of goods and services other than foodgrains, and particularly of livestock products and vegetables (the production of which is in Asian countries generally highly labor intensive), reduces employ-

[3] These calculations in effect assume equating of total expenditure and total income. If the higher-income classes reduce savings, or the lower-income classes increase dissaving, in response to higher foodgrain prices, then the expenditures on various categories of goods will be even less responsive to price. If, as is usually assumed to be the case, the marginal propensity to save is higher for high-income than low-income classes, then of course the proportion of the total adjustment which must be made by the lower-income classes is even greater. Similarly, the greater the extent to which foodgrain expenditure of higher-income consumers is for relatively more demand-elastic services associated with the foodgrain, the more this conclusion will be reinforced.

TABLE 3

EXPENDITURE ELASTICITIES FOR VARIOUS EXPENDITURE CATEGORIES, BY EXPENDITURE CLASSES, INDIA, 1964–65

	Bottom Two Deciles (Less than .49 Acres)	Decile 3 (.50–.99 Acres)	Deciles 4 and 5 (1.00–4.99 Acres)	Deciles 6, 7, and 8 (5.00–9.99 Acres)	Decile 9 (10.00–14.99 Acres)	Lower ½ of Decile 10 (15.00–29.99 Acres)	Upper ½ of Decile 10 (30.00+ Acres)	Mean for All Classes
Mean per capita monthly consumer expenditure (Rs)	8.93	13.14	17.80	24.13	30.71	41.89	85.84	24.43
Expenditure elasticities for:								
Foodgrains	1.04	.71	.53	.40	.31	.24	.12	.39
Milk and milk products	3.34	2.46	1.97	1.61	1.39	1.18	.88	1.60
Meat, eggs, and fish	2.34	1.83	1.55	1.34	1.21	1.09	.91	1.33
Other foods	.06	.53	.79	.98	1.10	1.22	1.38	.99
Tobacco	.74	.74	.74	.74	.74	.74	.74	.74
Vanaspati	5.41	3.76	2.84	2.17	1.76	1.36	.80	2.14
Other oils	2.68	1.86	1.40	1.06	.86	.66	.38	1.05
Sweeteners	2.54	1.81	1.40	1.11	.92	.75	.50	1.10
Cotton textiles	1.68	1.31	1.10	.95	.86	.77	.64	.95
Woolen textiles	3.94	3.17	2.74	2.42	2.22	2.04	1.77	2.41
Other textiles	*	1.03	1.63	2.08	2.35	2.61	2.99	2.10
Footwear	2.43	1.90	1.58	1.34	1.20	1.06	.86	1.34
Durables and semidurables	1.02	1.31	1.47	1.59	1.66	1.73	1.83	1.59
Conveyance	2.06	2.06	2.06	2.06	2.06	2.06	2.06	2.06
Consumer services	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Education	2.12	2.12	2.12	2.12	2.12	2.12	2.12	2.12
Fuel and light	1.29	1.05	.92	.82	.77	.71	.63	.82
House rent	5.94	4.53	3.75	3.17	2.82	2.48	2.00	3.15

SOURCE.—See table 1.
* Negligible.

ment. To the extent that such reduction in employment reduces incomes and hence demand by the poor, the increase in price of foodgrains will be dampened. This indirect effect of foodgrain price changes of course complicates empirical analysis: the greater the employment effect, the less will be the price increase. But either way the poor pay—in terms of lower real wages as prices rise or in reduced employment caused by the decline in real income of the upper-income classes.

The foregoing partial analysis is based on the calculation of the income effect of a relative price change. The extent to which observed behavior is consistent with it depends on the extent of the substitution effects and, of course, on the extent to which countervailing or reinforcing employment, income, and stocking effects occur. Substitution effects of relative price changes cannot be determined on an a priori basis and empirically cannot be separated from several other influences. However, useful observations can be made as an extension of the preceding analysis.

First, to the extent that foodgrains are an inferior good for the poor, the income effects will be reinforced. In assuming an inferior-good status, it should be remembered nevertheless that the poor have already reduced consumption of other goods to a very low and perhaps biologically minimal level.

Second, to the extent that higher-income groups have positive substitution effects, the income effects will, of course, be reduced by the substitution effects. However, although in the short run higher-income consumers may substitute livestock products, fruits, and vegetables for grain, the aggregate impact is likely to be small—first, because the same factors of weather and demand are likely to raise prices of those commodities also; and second, because in the longer run those commodities will compete with grain for the same production resources. It seems less likely that strong substitution effects would prevail between grain and nonfood commodities.

Finally, it should be remembered that grain is itself not a homogeneous category, so substitution of lower-priced for higher-priced varieties may allow reduced expenditures without a commensurate reduction in quantity, though with a possible reduction in nutritive value. In the short run, the supply of the inferior types of grain will be inelastic, and the search for a cheaper mix of grains will simply reduce the quality-related price disparities, rather than mitigate the effects on consumption.

Substitution effects are probably less important in reducing the effect of production changes on price than are storage effects and employment effects. The market is usually insulated to some extent from declines in the current production of foodgrains by the availability of carryover stocks, unless there is a very large change in production or

a succession of bad harvests. There is clear evidence that farmers build stocks in good years and deplete them in poor years.[4] Thus, in India, the price response to poor crops was much more substantial in 1966–67 than in 1965–66, a much "worse" year; similarly for 1973–74 compared with 1972–73.

As pointed out above, the secondary effects on employment of an increase in foodgrain prices could be as important in depressing the real incomes of the poor as the direct effects of price on consumption.

With these important caveats in mind, table 4 is of interest in suggesting the distributive impact on consumers of a 10% decline in the supply of foodgrains, using the elasticities implicit in the preceding analysis, and assuming no compensating decline in employment or secondary effects from the effect of the price change or producers' incomes.

In this analysis, the lowest two deciles in the income distribution of consumers suffer a 36.6% decline in real income compared with a decline of 7.9% for the top 5% in the income distribution (table 4). Similarly, the lowest-income deciles experience a 39.5% decline in foodgrain consumption, compared with 1.3% for the top income group (calculated from tables 1 and 4). The large reduction in consumption of nonfoodgrain commodities shows clearly that there would be large secondary effects on employment, greatly reducing the foodgrain price increases (table 4).

The foregoing data show one additional relationship between foodgrain prices and low-income consumers. The poor spend a high proportion of increments to income on foodgrains: the bottom two deciles in the income distribution spend 59% of increments to income on foodgrain, compared with only 2% for the top half of the tenth decile (calculated from tables 1 and 3). Thus, the role of price on the supply function for this crucial wage good must enter importantly into a full analysis of the relation between price and income distribution, particularly given the important role of employment in determining the income of lower-income families.

II. Direct Effects of Foodgrain Price Change on Distribution of Income among Producers

The effects of relative price changes on agricultural producers differ from the effects on consumers in two important respects. First, the income effect, assuming production is constant, is in the same rather than in the opposite direction as the price change. Second, the largest effects,

[4] For an analysis of this point and estimates of magnitudes, see John W. Mellor and Ashok Dar, "Determinants and Development Implications of Foodgrains Prices, India, 1949–50 to 1963–64," *American Journal of Agricultural Economics* 50 (November 1968): 962–74.

TABLE 4

DECLINE IN CONSUMER EXPENDITURE IN DIFFERENT INCOME CLASSES AS A RESULT OF 10% DECLINE IN SUPPLY OF FOODGRAINS, BY INCOME CLASS, INDIA, 1964–65

	Bottom Two Deciles	Decile 3	Deciles 4 and 5	Deciles 6, 7, and 8	Decile 9	Lower ½ of Decile 10	Upper ½ of Decile 10	Mean for All Classes
Per capita monthly consumer expenditure	8.93	13.14	17.80	24.13	30.71	41.89	85.84	24.43
Expenditure on:								
Foodgrains	1.909	1.747	1.396	1.025	.773	.455	.166	.968
Milk and milk products	.196	.497	.700	.836	.884	.888	.755	.828
Meat, eggs, and fish	.085	.140	.176	.201	.209	.213	.202	.198
Other foods	.026	.248	.408	.568	.698	.876	1.412	.567
Tobacco	.051	.065	.075	.077	.079	.079	.070	.078
Vanaspati	.020	.052	.086	.134	.144	.145	.100	.129
Other oils	.136	.220	.247	.230	.200	.152	.070	.226
Sweeteners	.147	.227	.256	.252	.227	.190	.109	.228
Cotton textiles	.286	.383	.415	.418	.400	.366	.279	.413
Woolen textiles	...	.011	.026	.039	.056	.075	.141	.038
Other textiles	...	.004	.005	.011	.112	.043	.022	.011
Footwear	...	.040	.050	.054	.109	.058	.050	.056
Durables and semidurables	.026	.050	.079	.113	.157	.213	.451	.116
Conveyance	.030	.065	.104	.116	.230	.351	.412	.161
Consumer services	.060	.010	.142	.193	.232	.295	.479	.188
Education	.031	.060	.100	.165	.237	.360	.922	.163
Fuel and light	.266	.326	.344	.343	.333	.306	.245	.336
House rent	...	.032	.059	.128	.193	.310	.679	.124
Total decline in real income in each class	3.27	4.17	4.670	4.90	5.27	5.38	6.77	4.89
New real expenditure	5.66	8.97	13.13	19.23	25.44	36.51	79.07	19.95
Decline in real expenditure (%)	36.6	31.7	26.7	20.3	17.2	12.8	7.9	20.0

SOURCE.—See table 1.

NOTE.—The percentage rise in the prices of foodgrains due to a 10% decline in supply is calculated, and then the adjustment made in consumption of all commodities due to the rise in the price of foodgrains is shown in this table. (i) The percentage rise in price of foodgrains = $[(dQ/Q) \times 100]/e$, where dQ/Q is a proportionate decline in the foodgrains supply and e is the price elasticity of demand for foodgrains in the mean class. From table 2, the decline in expenditure on foodgrains corresponding to mean class as a result of a 10% rise in the price of foodgrains is 0.147, implying a 1.52% decline in foodgrains consumption expenditure. Therefore, the percentage rise in the prices of foodgrains = 10/.15 = 67%. (ii) This 67% rise in the price of foodgrains is reflected in the decline in the consumption expenditure on all commodities. See the footnote to table 2 for the basis of calculation of the decline in expenditure on each commodity.

both relative and absolute, fall on the producers with the largest marketings (and presumably with the higher incomes).

The effect of a price change which occurs independently of change in the volume of domestic production is easier to analyze than the effect of a price change in response to a production change, perhaps induced by variations in the weather. These two somewhat different cases will be discussed in order, followed by analysis of the effects of price change on production.

The Effect on Producers of Change in Relative Prices with Production Constant

The relationships described below refer to effects of price changes on producers when quantity produced stays constant, as could happen if the price changes were due to a foreign food-aid program. It could also happen as a result of commercial trade, although in that case the relationships are more complex because change in imports and exports of foodgrains would presumably be offset by trade in other commodities, with further price and income effects.

The effect of relative change in agricultural prices on producers' incomes depends on (i) the quantity they produce, (ii) the quantity of home consumption and hence of marketings, and (iii) the quantity of purchased production inputs. The effect of price changes is much greater in both absolute and percentage terms on larger farms than smaller farms—the larger farms normally produce more, market a higher proportion of their production, and have a higher proportion of output represented by purchased inputs.

Table 5 illustrates these relationships by relating size classes of farms to level of production, home consumption, and marketings. For the smallest farmers, a price increase actually decreases income, because they are net purchasers of foodgrain, presumably paid for largely by working as laborers. It is only in the fourth and fifth deciles and above that a substantial rise in income occurs. In the upper income deciles, the price effect is more nearly proportionate to income since the bulk of production is marketed—it is actually less than proportionate because of the fixed share of output assumed to be retained for feed, seed, and waste and because the calculation relates to gross value of output rather than to the value of output net of cash production costs.

The absolute increase in income resulting from a 10% price increase is about 60% larger for the ninth decile than the average for the sixth, seventh, and eighth deciles and over six times larger in the upper half of the tenth decile than the average for the sixth, seventh, and eighth deciles.

Thus, if a foodgrain price increase is seen as a simple transfer of income from consumers to producers, it largely takes place between

TABLE 5

CHANGE IN THE GROSS VALUE OF FOODGRAINS CONSEQUENT TO VARIOUS CHANGES IN PRODUCTION AND PRICE, BY RURAL INCOME CLASS, INDIA, 1964–65

	Bottom Two Deciles	Decile 3	Deciles 4 and 5	Deciles 6, 7, and 8	Decile 9	Lower ½ of Decile 10	Upper ½ of Decile 10
1. Average gross acres sown per reporting holding	.29	.98	3.85	8.05	12.57	20.70	45.50
2. Gross value of foodgrains production*	4.06	13.72	53.91	112.72	176.01	289.85	637.11
3. Foodgrain consumption expenditure	4.83	6.84	8.31	9.58	10.45	11.37	12.80
4. Value of foodgrains marketed	−1.38	4.83	37.51	86.23	139.16	235.00	558.74
5. Effect of 10% rise in price of foodgrains, with no change in production, on value of foodgrains marketed	−.14	.48	3.75	8.62	13.92	23.50	25.87
6. Row 5 as a percentage of gross value of foodgrains production	−3.4	3.5	7.0	7.7	7.9	8.1	8.3
7. Effect of 10% decline in production and 5% rise in foodgrains' price on value of foodgrains marketed	−.44	−.99	−2.93	−5.75	−8.75	−14.05	−30.42
8. Row 7 as a percentage of gross value of foodgrains production	−10.8	−7.2	−5.4	−5.1	−5.0	−4.8	−4.8
9. Effect of 10% decline on production and 10% rise in foodgrains price on value of foodgrains marketed	−.52	−.80	−1.29	−1.91	−2.54	−3.53	−6.69
10. Row 9 as a percentage of gross value of foodgrain production	−12.8	−5.8	−2.4	−1.7	−1.4	−1.2	−1.1
11. Effect of 10% decline in production and 20% rise in foodgrains' price on value of foodgrains marketed	−.70	−.44	2.01	5.75	9.88	17.52	40.77
12. Row 11 as a percentage of gross value of foodgrain production	−17.2	−3.2	3.7	5.1	5.6	6.0	6.5

SOURCES.—Government of India, Cabinet Secretariate, *The National Sample Survey*, 18th Round, February 1963–January 1964, no. 142, tables with notes on consumer expenditure, 1968; and *The National Sample Survey*, 17th Round, September 1961–July 1962, no. 162, tables with notes on some features of land holdings in rural areas, 1969.

NOTE.—In this analysis, expenditure on foodgrains is assumed to remain the same irrespective of changes in production and prices of foodgrains. The difference between production and consumption is due to a 10% allowance for feed, seed, and waste. For row 1, the cumulative percentage of rural population in various landholding classes was calculated from *National Sample Survey* (*NSS*) of landholdings for 1961–62. Similarly from *NSS*, 1963–64, data on consumer expenditure for rural households, the cumulative percentage distribution of rural population in various expenditure classes was calculated. The two cumulative distributions were matched to ascertain the approximate correspondence between level of expenditure and landholding. Then the average area cultivated per reporting holding in each consumer expenditure class was obtained. For row 2, the gross output of rice was obtained on the assumption that all the acreage was planted to rice. Hence, it is considered as gross output of foodgrains. Taking the all-India average yield of rice as 1,078 kg. per hectare and the price of rice as Rs 1.925 per kilogram as the price of all foodgrains, the gross value of foodgrain production per annum was obtained. Further, assuming that the average farm family size was five, the gross value of foodgrain production per capita per month was obtained. For row 3, see table 1. For row 4, the value of foodgrain marketings per capita per month = the gross value of foodgrain production per capita per month − retentions. Retentions = seed + feed + waste + consumption. Seed, feed, and waste is taken to be 15% of gross value of output.

* Per capita per month for this and all subsequent categories.

high-income consumers, who expend the largest absolute amount on food, to high-income producers, who market the largest absolute quantities. In terms of a percentage change in income, the transfer causes the largest percentage decline in the income of low-income consumers and the largest percentage increase in the income of high-income producers.

The Effect on Producers of Concurrent Change in Production and Price

Changes in the relative price of foodgrains more usually occur as a result of changes in domestic output, due to either short-term weather changes or more permanent technological changes, and thus the effects of price changes on producers are usually offset wholly or in part by production changes.

While a production change in response to the weather or a technological change affects producers' incomes in direct proportion to their levels of production, the countervailing price change is more nearly proportional to marketings. Thus, if price increases by the same percentage as production declines, the incomes of all producers decline at least slightly. If the price increase is half as large in percentage terms as the production decline, producers' incomes, of course, decline more precipitously. In both cases, the percentage decline in income is greater for low-income than high-income farmers. However, if the price increase is larger than the production decline, then farmers in the upper-income classes will experience an increase in income while the lowest-income farmers may still experience a decline in income.

These relationships are illustrated in table 5, which depicts the effects of a 10% production decline combined with price increases of respectively 5%, 10%, or 20%, giving the effects of alternative assumptions as to the price elasticity of demand. In general, the price change will be counter to the production change, and since demand is inelastic the change in price will presumably be more than proportionate to the change in production. Given a 10% decline in production, a 10% increase in price is consistent with unit elasticity; a 20% increase in price is consistent with an elasticity of —0.5; and a 5% price increase is consistent with an elasticity of —2.0. The elasticity of —0.5 has often been justified on theoretical and empirical grounds.[5] The price rise of only 5% is included to illustrate the comparative effects of a price stabilization program.

Two caveats are in order in assuming a price elasticity of demand. First, the national magnitude depends to a large extent on how the income effect of changes in prices is distributed, especially if adjustment

[5] See, e.g., L. M. Goreux, *Demand Analysis for Agricultural Products*, Agricultural Planning Study no. 3 (Rome: FAO, 1964); Mellor and Dar.

to price change occurs largely through the income effect. The income or expenditure elasticities vary greatly among income groups (table 3). Second, where private carryover stocks exist, change in prices with respect to change in production will be muted. This implies that efforts to influence price fluctuations by providing subsidized government buffer stocks may, in part, only displace private stocks, making the public cost of such programs much higher than the cost of just the increments to national stocks.

It should be noted from the above that price stabilization programs destabilize small producers' real incomes and stabilize consumers' incomes and large producers' incomes. Thus, it is significant that the introduction of a less unstable price (row 8 compared with row 12 of table 5) increases the decline in income in years-of-production decline for the third through the fifth deciles in the income distribution. Reduced price instability stabilizes income for the lowest-income farmers because they are net consumers, and for the highest-income producers because they market a high proportion of what they produce.

III. The Effect of Relative Changes in Agricultural Prices on Agricultural Production

A slow rate of increase in food production is increasingly recognized as a major limitation to increase of employment and income of low-income families.[6] Without a commensurate increase in the supply of food, growth in paid employment and the consequent rise in demand for wage goods will cause an increase in food prices, the effects of which may substantially neutralize the benefits from increased employment and indeed force a reversal of high-employment policies. Adequate additional supplies of such wage goods can rarely be mobilized through reallocation of existing domestic supplies or through international trade. Thus, policies on employment, agricultural production, and agricultural prices must be closely linked. Change in relative prices plays at most a very limited role in increasing agricultural production in the context of traditional technology. But if used to complement technological change in agriculture, price policy may speed the growth of production significantly. In this context, too, price policy may encourage the adoption of income-increasing innovation by low-income producers through its influence on profitability as well as on risk and uncertainty.

[6] For a full exposition of these relations, see John W. Mellor, *The New Economics of Growth: A Strategy for India and the Developing World* (Ithaca, N.Y.: Cornell University Press, 1976). For a more theoretical presentation, see Uma J. Lele and John W. Mellor, *Technological Change and Distributive Bias in a Dual Economy*, Occasional Paper no. 43 (Ithaca, N.Y.: Department of Agricultural Economics, Cornell University—USAID Employment and Income Distribution project, June 1971). For a briefer, more policy-oriented statement, see Uma J. Lele and John W. Mellor, "Jobs, Poverty and the 'Green Revolution,'" *International Affairs* 48 (January 1972): 20–32.

Prices and Production in the Context of Static Technology

With technology given, an increase in relative agricultural prices increases the supply of agricultural commodities by movement along the production function. Such an increase in production is, by definition, at an increasing real cost in resources and shifts the distribution of income against low-income consumers. Agriculture in low-income countries is commonly operating near the top of the total product curve, with low marginal returns to added inputs, and is, consequently, often a sector of highly inelastic aggregate supply.[7]

The extent to which the income effect of increased wage employment of the poor will be neutralized by increased food prices depends on (i) the incremental budget share allocated to foodgrains by those in wage employment, (ii) the elasticity of supply of foodgrains. and (iii) the cross-elasticities of demand for foodgrains. Income increases will be nullified by food price increases as the incremental budget share approaches one, the supply elasticity approaches zero, and the cross-elasticity approaches zero. In a low-income country for which the incremental budget share allocated to foodgrains by the laboring classes may be 0.59 (calculated from tables 1 and 3), the aggregate supply elasticity for basic foodgrains is as low as —0.1; and the cross-elasticity low, the income increase to the laboring classes from employment may be largely eliminated by the consequent price increases.

The literature dealing with agricultural supply response is much greater with respect to substitutions among individual commodities than with respect to the more complex, but here more relevant, problem of aggregate supply of foodgrains and of agricultural wage goods more generally. What literature there is suggests quite inelastic aggregate supply, on the order of —0.1 to —0.2.[8]

The supply of basic agricultural wage goods is perhaps likely to be most elastic if a substantial proportion of land and other resources is devoted to annual crops consumed either domestically by high-income people or exported. A transfer of acreage may then be effected with little decline in marginal productivity. In such a case, the use of a price increase policy to encourage food-crop production, and the maintenance of high relative prices as a means of implementing that policy, may be successful.

[7] For a more complete discussion, see John W. Mellor, *Economics of Agricultural Development* (Ithaca, N.Y.: Cornell University Press, 1966), chap. 11.

[8] For an analysis of aggregate supply elasticities, see Robert Herdt, "A Disaggregate Approach to Aggregate Supply," *American Journal of Agricultural Economics* 52 (November 1970): 512–20; Howard Barnum, "A Model of the Market for Foodgrains in India, 1948–64," Technical Report no. 23 (Berkeley: Project for the Evaluation and Optimization of Economic Growth. Institute of International Studies, University of California, 1970); Krishna; Mellor, *Economics of Agricultural Development*, chap. 11.

A few countries have, at times, followed price policies which have depressed agricultural prices substantially relative to international relationships (e.g., Thailand), with consequent low levels of input use by international standards and consequent discouragement of production for the market.[9] Particularly if the production functions are essentially linear, except for near the bottom and top of the function, rectification of such policies may have dramatic effects on input use and on production.

In the face of inelastic domestic production, the supply of foodgrains may, of course, be augmented by imports, depending on the elasticities of supply and demand for exports to pay for them and on the elasticity of supply of foodgrains for import. However, the coefficients for these variables too may be quite inelastic, particularly for large countries or large aggregates of small countries. As an alternative policy, the marginal redistribution of income effected by fiscal policy is also unlikely to achieve an adequate transfer of food from high-income to low-income classes, because of the highly disparate marginal propensities to consume at the various income levels.

Thus, one may conclude that in the context of static agricultural technology the gains to the poor from expanded employment are likely to be substantially offset by increased prices of food as increased demand exerts its pressure on an inelastic supply. It is these relationships that turn attention to technological change generally and the role of price policy to technological change in agriculture more specifically.

Prices and Production in the Context of Technological Change

Efficiency increasing technological change in agriculture allows an increased supply of wage goods without an increase in price.[10] Thus, incomes of low-income people may increase through employment without an offsetting effect of rising wage-good prices. The benefits-of-scale neutral technological change will be distributed among producers more nearly in proportion to output than to marketings and, thus, need be less skewed toward larger producers in their benefits than increased prices. Scale neutral technological change is, of course, directly a product of development of institutions for research, education, input distribution, etc., and not of policy for price changes. However, increased prices may play an important indirect role in the adoption of new technology. Insofar as that is the case, there may be a trade-off between short-run losses by the poor from higher agricultural prices and long-

[9] See Jere R. Behrman, *Supply Response in Underdeveloped Agriculture* (Amsterdam: North-Holland Publishing Co., 1968).

[10] For a wide range of examples, see John W. Mellor and Uma Lele, "Growth Linkages of the New Foodgrains Technologies," *Indian Journal of Agricultural Economics* 28, no. 1 (January–March 1973): 35–55.

run gains from a shift of the agricultural production function, a larger supply of wage goods with favorable employment implications, and eventually lower agricultural prices as equilibrium is reached in agriculture with lower costs of production.

Despite its importance to both growth and income distribution, there is little empirical evidence as to the relation between agricultural prices and the pace of technological change. Of course, increased relative output prices increase further the disequilibrium induced by the lower costs of new technology, thereby accelerating output increase. That influence is thought in agriculture to be particularly strengthened by effects which reduce the incidence of uncertainty. Higher prices reduce the probability of loss from an innovation by increasing expected average profitability. More stable prices may also reduce uncertainty for some farmers.

In a substantial analysis of farm management data, G. M. Desai shows considerable underutilization of fertilizer in certain Indian states in circumstances in which the rate of return on investment is high but the absolute return per farm is low.[11] Reasoning from a regression analysis of cross-section data on fertilizer use per acre and relative fertilizer prices from several states in India, he suggests that under these conditions adoption of fertilizer is highly responsive to price.

The relation between price policy and variance in agricultural incomes is highly complex. High variance in net income, at the very least, has an unfavorable effect on income distribution by skewing the pattern of adoption toward already higher-income farmers—reflecting their greater risk-bearing capacity.

Such is clearly documented by Schluter in a study of the Surat District, India, in which he finds a clear trade-off between variance and income, with small farmers choosing low-value, low-variance crops, as compared with larger farmers.[12] Expected value-variance (E-V) frontiers estimated for nine representative farms by Schluter show that observed incomes are generally much lower than the maximum levels corresponding to economic efficiency, while the observed cropping patterns are close to the estimated E-V frontiers. In a sample of 33 farmers, three have points on the E-V frontiers, and 14 would increase real income less than 5% if they shifted on to the E-V frontiers, given the same level of risk. The increase in income that could be achieved by

[11] Gunvant M. Desai, *Growth of Fertilizer Use in Indian Agriculture: Past Trends and Future Demand*, Bulletin no. 18 (Ithaca, N.Y.: Cornell International Agricultural Development Program, 1971).

[12] Michael G. G. Schluter, *Interaction of Credit and Uncertainty in Determining Resource Allocation and Incomes on Small Farms, Surat District, India*, Occasional Paper no. 68 (Ithaca, N.Y.: Department of Agricultural Economics, Cornell University–USAID Employment and Income Distribution Project, February 1974).

such a shift is between 5% and 10% for 12 of the farmers and over 10% for only four farmers.

Schluter's data show that an increase in net income can be achieved by increasing the proportion of acreage planted to cash crops, but that in such a transfer, a Rs 100 increase in net income typically entails greater than a Rs 100 increase in the absolute deviation of income from its expected value. It is clear why poor farmers may choose crops which yield lower returns but are less risky, particularly subsistence crops. New high-yielding varieties of food crops have many of the characteristics of traditional cash crops, including high-cash production costs and a high proportion of output marketed, and thus might be expected to evidence similar behavior.

However, in agriculture, yield variation due to weather is generally a more important source of variance than price. This is particularly true when a large proportion of output is retained for domestic consumption. And, the extent to which price stabilization even increases the stability of producers' incomes is, in practice, dependent on several factors, important among which is the extent to which movements in price are inversely related to movements in production. At the micro-level, that depends on the extent to which production changes in a particular area are similar to changes in national aggregates and on the degree of national integration of markets. Thus, Schluter, in a simulation of the effect of changes in price variance, using actual farm data from the Surat District, India, found that in four out of six situations price stabilization actually increased the coefficient of variation of revenue.[13]

Finally, in selecting a price policy to facilitate efficiency increasing technological change in agriculture, it must be remembered that increased profitability and reduced variance in income may be achieved by appropriate investment in such items as research, education, and irrigation—quite possibly on a more cost-effective basis than through price policy and with lesser short-run deleterious effects on income distribution.

IV. Effects of Agricultural Price Policy on Employment

Throughout this paper emphasis has been placed on the trade-off between inverse change in agricultural prices and employment in influencing the income of low-income families. In Part I, note was made of

[13] The data were for rice and cotton (for each, fertilized and unfertilized), sorghum, and groundnuts. For 1962–72 the coefficient of variation of revenue (price × yield) was reduced slightly with both fixed prices at the mean and prices fixed at 50% of the mean for sorghum and groundnuts; the coefficient of variation of revenue was increased by a much larger margin in the other four cases (Schluter).

the income effect of agricultural price changes on the level and pattern of consumption of other commodities and consequent indirect employment effects. Part III discussed the potential influence of agricultural price policy on agricultural production, the supply of wage goods, and the potential employment level. The new high-yielding crop varieties are noted for their generally low elasticity of employment with respect to output. Thus, the primary significance for employment of the new foodgrain technologies lies in their potential to relax the wage goods' constraint and to generate increased farm incomes, which may promote a secondary increase in employment.[14] In this section, three further aspects of the relation between agricultural prices and employment are explored: (*a*) the effect of relative agricultural prices on the labor intensity of the agricultural output mix; (*b*) the effect of relative agricultural input prices on the choice of technique in agricultural production; and (*c*) the effect of relative agricultural prices on the level and structure of nonagricultural employment.

Prices and the Agricultural Output Mix

Choice of cropping pattern is one of the most important factors influencing labor requirements in agriculture, and, thus, because of the relative magnitude of the agricultural sector, it is one of the most important determinants of overall employment in a low-income country. B. M. Desai in a detailed analysis of farm-management data from the Surat District, India, calculates that 90% of the differences in income per acre among farms is due to differences in cropping pattern, which affect income largely through differences in labor input, rather than to differences in the intensity of inputs' use in specific crops.[15] Desai and Schluter show from farm management data for the Surat District, India, that human labor use is 60 and 37 days per acre on groundnuts and cotton, respectively.[16] A transfer of one-quarter of the cotton acreage to groundnuts would add over 2.1 million man-days of employment per year in the Surat District. That is about eight times as much employment to be added in that district as by the special "crash scheme for rural employment" intended as a major source of rural employment. In this case, not only do the two crops compete for the same set of nonlabor resources and have substantial differences in labor requirements, but a portion of

[14] Mellor and Lele, "Growth Linkages."

[15] B. M. Desai, *Relationship of Consumption and Production in Changing Agriculture: A Study in Surat District, India*, Occasional Paper no. 80 (Ithaca, N.Y.: Department of Agricultural Economics, Cornell University–USAID Technological Change in Agriculture Project, February 1975).

[16] G. M. Desai and Michael G. G. Schluter, "Generating Employment in Rural Areas," in *Seminar on Rural Development for the Weaker Sections* (Bombay: Indian Society of Agricultural Economics, May 1974), pp. 143–52; and Mellor, *New Economics of Growth*, p. 86.

the domestic supplies of each commodity is also imported. Thus, the relative domestic prices, production, and aggregate employment can be influenced by import policy.

The data cited from Schluter in Part III, showing the clear trade-off between average income and variance in income in the choice of crop combination has relevance to employment since the higher-income-generating crops were more labor intensive. Thus, effort to reduce variance in income would in that case increase employment, particularly on the smaller farms with relatively larger labor supply.

Despite the importance of agricultural output mix on employment and the substantial literature showing significant elasticities of output substitution at the farm level, there has been little policy analysis of this issue. Needed study would examine not only employment and elasticities of substitution among crops but, equally important, would analyze potentials to shift trade policy and domestic demand toward more labor-intensive commodities. Most simply, export and import policy may be used marginally to facilitate a shift in relative domestic prices and production toward more labor-intensive commodities. Temperate-zone nations have done this particularly in the case of sugar—historically, a labor-intensive crop. India, in the earlier example, could shift the product mix from cotton toward groundnuts by importing more cotton and less vegetable oil, with a consequent increase in employment. Export subsidies on vegetables could have a similar effect. Such policies are particularly attractive if they compensate for the effects of the labor market and other imperfections, causing suboptimal utilization of labor on small farms.

Domestic demand structure may also be influenced toward more labor-intensive commodities through tax and subsidy schemes. Related and perhaps more important, demands for relatively labor-intensive agricultural commodities tend to be relatively elastic with respect to income, providing a significant opportunity for rising incomes to favor rising employment. Unfortunately, there is a tendency, because of the bulky, perishable nature of many such commodities, for marketing bottlenecks to result in restraint of consumption through price increases which are not transmitted to the farm level. Institutional credit gaps at the farm level, for commodities with generally high working-capital requirements, may also inhibit the desired expansion of demand. Thus, as for other aspects of agricultural price policy, programs must go beyond the price policies and indicators to substantive aspects of marketing and production. In this context, an employment-oriented price policy should (*a*) recognize the employment implications of alternative price relationships among agricultural commodities, (*b*) see that overt price policies do not discriminate against the relatively labor-intensive commodities, and (*c*) use movements in market-determined prices as

indicators of marketing and production bottlenecks that may be dealt with through other policies.

Relative Input Prices

The dramatic displacement of labor often occasioned by farm mechanization and its frequent association with effective subsidization of farm machinery prices relative to labor has prompted a substantial literature.[17] Given that extensive treatment, attention is here brought to two features which make the statement of effective policy difficult in this area.

First, although inappropriate pricing policy is frequently deplored, there is still controversy as to whether market prices of labor adequately reflect the equivalent of perfect market supply prices.[18] It is thus difficult to know whether or not compensating taxes on machinery may be in order.

Second, and related to the first, considerable controversy exists as to the precise nature of the labor supply, particularly given the complexities of seasonal cycles in both demand and supply of labor.[19] Thus, Donovan shows with a linear programming analysis based on farm-management data for an area in Mysore, India, that the introduction of hand tractors allows a substantial increase in total employment.[20] It does so by shortening land preparation time sufficiently to allow a not otherwise possible second crop. It follows that at such time as mechanization is appropriate for breaking labor bottlenecks it may be as appropriate a recipient of price subsidy and other facilitative measures, particularly for small farmers, as any other element of production and labor-absorbing technological change. The full complexities of policy in this area are underlined by Donovan's analytic position that seasonal labor migration, which of course brings other problems, can meet the labor bottleneck as effectively as mechanization.

Finally, it should be noted that fertilizer and other chemical inputs also substitute for labor, and, hence, subsidization of their prices will reduce employment unless ancillary policies ensure an aggregate increase in output, with a set of direct and indirect employment effects as elaborated in preceding sections.

[17] H. Rao, "Farm Mechanisation in a Labour Abundant Economy," *Economic and Political Weekly* 7, annual no. (February 1972): 393–400.

[18] See, e.g., the review and analysis in Mellor, *New Economics of Growth*, chap. 4.

[19] Ibid.

[20] Graeme W. Donovan, *Employment Generation in Agriculture: A Study in Mandya District, S. India*, Occasional Paper no. 71 (Ithaca, N.Y.: Department of Agricultural Economics, Cornell University–USAID Employment and Income Distribution Project, June 1974).

Agricultural Prices and Nonagricultural Employment

The basic relationships between agricultural price policy, technological change in agriculture, supply of wage goods, and employment were discussed in Part III. In that argument, relatively low agricultural prices are seen as desirable in the longer run not only to an immediate raising of the real incomes of the poor but also in stimulating longer-term employment growth—as long as technological change effects a continuous upward shift of the supply curve for agricultural commodities.

Relative agricultural prices are often depressed by import and foreign-exchange pricing policies specifically intended to encourage industrial growth. Clearly, such policies may directly encourage industrial employment while in the longer run discouraging production of the basic agricultural wage goods, with a consequent deleterious effect on employment potentials. Whether such policy is desirable hinges on an argument for industry essentially analogous to that for relatively higher agricultural prices intended to encourage accelerated application of efficiency increasing technological change in agriculture. Policies which boost the domestic production of industrial consumer goods which are relatively efficient and labor intensive, and eventually effect a reduction in the prices of these goods, need have only short-run adverse effects on relative agricultural prices and agricultural production. As they expand, they generate increased demand for agricultural wage goods from increased industrial employment, tending to raise relative agricultural prices.

However, the effects may be quite different when import restrictions are introduced to protect capital-intensive, low-efficiency industrial processes. Protection of this kind generates little increase in employment or in demand for food, and so the depression of relative agricultural prices continues, potentially reducing production in the traditional agricultural sector and weakening incentives for technological change in agriculture.[21] Such an effect may continue indefinitely if those industries remain inefficient relative to foreign sources of supply.

V. Conclusion

The data presented demonstrate dramatically that the income effect on low-income people of food price changes is large, and that the bulk of adjustment to reduced food supplies is made by low-income people. Conversely, of course, changes in the income of low-income people are reflected to a large degree as change in the demand for food.

Change in food prices causes a larger percentage change in the real incomes of low-income consumers but a larger absolute change in the

[21] For an analysis of such an effect in the Indian context, see Mellor, *New Economics of Growth*, chap. 7.

real incomes of high-income consumers. Thus, there is potential for substantial secondary effects on employment and incomes of the poor arising from the primary effects on the consumption pattern of the more well-off.

The effects of relative price changes on agricultural producers differ from the effects on consumers in two important respects. First, the income effect, assuming production is constant, is in the same rather than in the opposite direction as the price change. Second, the largest effects, both relative and absolute, fall on the producers with the largest marketings (and presumably with the higher income).

Demand for food may be effectively brought into balance with deficient supply through reduction in employment rather than an increase in price. High-income consumers may prefer policy measures of that type. Similarly, if the increased demand for food accompanying the increased employment of low-income people is not met by an increased food supply, the employment-based increase in real income will be substantially reduced by price increases. Thus, an employment program, or an income-transfer program for the poor, will be inefficient in assisting them unless provision is made for an enlarged supply of basic food commodities. It follows that in designing income and employment programs attention needs to be paid to the material balances and not just the fiscal balances. From the data in Part I, it can be seen that one monetary unit of income transferred from the richest to the poorest classes releases demand for 0.02 units of foodgrain but creates a new demand for 0.59 units, an imbalance in the ratio of 30 to 1. To state the position clearly, barring a strict rationing system. increased agricultural production may be a necessary precondition for improving the incomes of the poor. It follows, of course, that a program of foreign food aid and, to a lesser extent. commercial imports can be effective in facilitating an employment increase, particularly in the short run.

The importance of an increased supply of food to the effectiveness of employment programs in raising the income of low-income families suggests the appropriate consideration in the analysis of production effects of agricultural price policy. The preponderance of the evidence shows that in the context of traditional technology aggregate food supply will normally be highly inelastic, and, hence, an upward shift in demand for food will result in magnified upward movements in food prices, with the consequent distribution effects shown in Part I. However. in the context of technological change, higher prices to producers may counterbalance the added risk and uncertainty associated with such change. If experience with new technologies itself reduces risk and uncertainty, higher prices may induce a shift to a new technology, which will not be reversed if prices later decline. Of course, domestic policy may so depress relative agricultural output prices as to virtually elimi-

nate use of certain key inputs, such as fertilizer, for market production, and in that case supply may be highly responsive to even modest changes in prices. Such a situation is often the result of government monopoly pricing. Changes in policy will be most effective if such policy has held production close to the subsistence level. The effect will be further enhanced if there is close interaction of such input use and new technology.

Research and education which dramatically reduce production costs may serve as an alternative to higher prices to induce innovation. Such measures do not have such deleterious effects on low-income consumers as higher prices, can also induce more permanent increases in productivity, and may have a less skewed distribution of net benefits to producers. Thus, price policy may be viewed as a competitor to other measures as well as a complement.

Relative agricultural prices affect employment through the labor intensity of the agricultural output mix, the labor intensity of agricultural technology, and the level and structure of nonagricultural employment. In each case, the importance of interactions of agricultural price policy with other policy measures is important.

Finally, the extent to which a change in terms of trade between agriculture and industry benefits the poor depends very much on the extent of the structural adjustments it encourages. A turn against industry will redress itself if it induces accelerated technological change in agriculture and consequent linkage effects with industry through relaxed wage-goods constraint and increased consumer demand. Conversely, a turn against agriculture will redress itself if it encourages accelerated industrial employment growth, consequent greater demand for agricultural wage goods, and increased efficiency of industrial production. A lack of the conditions for technological change in agriculture and a lack of the conditions for employment growth in industry will cause either of the respective price policies to fail.

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