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9. ABSTRACT <p>An examination of the dual effects of shifting terms-of-trade on 1) foodgrain production and 2) overall growth as judged by the aggregate level of savings, with an assessment of the combined effects on growth. Terms-of-trade were found to have a positive effect on foodgrain production but a negative effect on aggregate savings. By way of the positive effects on foodgrain production, they also had a positive effect on national income and thereby on saving. The net effect on savings of favorable terms-of-trade for foodgrain production was negative. Shifting the terms-of-trade in favor of foodgrain production is only one instrument available to policymakers and its efficacy in relation to other instruments, such as direct public investments in agriculture, continues to be debated. Policymakers in developing countries should not be blamed if they do not accept eagerly the policy advice of "positive pricing" enthusiasts. Though the conclusions of this paper are based on Indian experience, they may have a wider relevance to the policy options available to other developing countries.</p>		
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G. Parthasarathy and Mohinder S. Mudahar

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DEPARTMENT OF AGRICULTURAL ECONOMICS

Cornell University Agricultural Experiment Station
New York State College of Agriculture and Life Sciences
A Statutory College of the State University
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Contents

	<u>Page</u>
I. Introduction	1
II. Dynamics of Foodgrain Prices and Economic Growth	2
III. Empirical Analysis of the Linkages Between Prices and Growth	5
3.1 The Economic Model	5
3.2 Behavior of Prices and Terms-of-trade	8
3.3 Terms-of-trade, Savings and Economic Growth	11
IV. Summary and Conclusions	14
References	16
Appendix	18

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FOODGRAIN PRICES AND ECONOMIC GROWTH

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I. Introduction

In countries categorized as "high food-drain economies" 1/ foodgrain prices are a crucial factor shaping the growth of foodgrain production, inter-sectoral distribution of income, inter-class distribution of income, inter-sectoral resource transfers and overall growth of the economy. In an economy in which resources are privately owned and production is meant for the market, the incentive effects of foodgrain prices relative, to be sure, to input prices, are undoubtedly important and deserve recognition. 2/ The depressing effects of rising input prices on foodgrain production, particularly in the absence of shifts in production function, are readily recognized, especially when supplies of modern farm inputs are inelastic. However, the effects of rising foodgrain prices on the overall economy 3/ and in turn its effect on foodgrain production are not adequately clarified in the literature and policy advice is based usually on partial analysis of the problem. This paper seeks to analyze ramifications of foodgrain prices on overall economic growth and its effect in turn on foodgrain production.

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1/ "high food-drain economies" are those in which expenditure on food, especially foodgrains, forms the bulk of total consumption budget, Schultz [15].

2/ See the pioneering work of Krishna [9].

3/ For a discussion on some aspect of prices in relation to economic development, see Dantwala [3], Mellor [10], and Narain [13].

Section II puts forward the general dynamics of foodgrain prices and the economics of growth and brings out the conflicts involved in pursuing different policy programmes. The different components of the dynamics are analyzed empirically by using time series data from India in Section III. The components analyzed are (a) the behavior of foodgrain prices, manufacturing prices and terms-of-trade, (b) the effects of terms-of-trade and national income on savings, and (c) the relationships between investment, foodgrain production and economic growth. Finally, Section IV concludes with a recapitulation of the basic arguments of these dynamics and their implications for a policy framework.

II. Dynamics of Foodgrain Prices and Economic Growth

Foodgrain prices have effects on the overall growth of the economy via their impact on (a) foodgrain production, (b) non-foodgrain agricultural production, ^{4/} (c) domestic terms-of-trade between foodgrain prices and manufacturing prices, the effects of these on aggregate savings, and public savings in particular, (d) the impact of high foodgrain prices on labor cost and its effects on the overall cost structure, and (e) distribution of incomes.

High foodgrain prices could be expected to have a favorable impact on the decisions of foodgrain producers. As the product prices increase faster in relation to input prices, foodgrain farmers could be expected to use more inputs, and/or shift acreage to foodgrain production, invest in fixed capital on land, while the reverse situation will have a dampening effect on all these. In the absence of slack in the use of labor, land and other physical resources of the farmer, production increases depend in the short run on (a) increased availability of purchased inputs and (b) shift in acreage to foodgrain from non-foodgrain crops. However, in the long run (more than a couple of crop-years) foodgrain production depends on increased investments in land, through resource transfers generated through price increases to foodgrain producers, via changes in distribution of income.

Under conditions of scarcity of inputs like fertilizer, water, and power, either the same acreage is maintained if the price of foodgrains is not considered high enough relative to the prices of competing crops, or a shift from other crops to foodgrains takes place. In this situation, in the short run a high price policy for foodgrains may achieve increased foodgrain production, but only at the expense of non-foodgrain crops. The policymaker needs to assess the impact on non-foodgrain production, for it may be quite advantageous to acquire foodgrains in exchange for non-foodgrains or alternatively to save on foreign exchange in import of non-foodgrains. In this situation the high price policy for foodgrains will have to be considered not only in relation to its impact on foodgrain production but also

^{4/} Non-foodgrain agricultural production here refers to the production from all the farm crops other than foodgrain crops.

in relation to its impact on non-foodgrains. If there is a highly profitable technology, it may be more advantageous to spend resources on the extension of the technology rather than pursue a high foodgrain price policy which may be more costly to the overall economy.

High foodgrain prices have an effect on the budgets of the workers in manufacturing industries since expenditure on foodgrains forms the bulk of consumption expenditure. Since wages in "high food-drain economies" tend to be at subsistence levels, money wages need to be raised to enable workers to maintain a minimum level of subsistence. The real cost of manufacturing rises due to adverse domestic terms-of-trade. This has an effect on inter-sectoral savings depending upon the relative marginal saving propensities of the sellers of foodgrains in the agricultural sector, who gain, and sellers of manufactured commodities in the non-agricultural sector, who lose.

The industrial entrepreneur class has a far higher level of income and the marginal propensity to consume of this class is far lower than the marginal propensity to consume of the class of sellers of foodgrains. As a result of these differences in the marginal propensities, a shift in income arising out of the shift in domestic terms-of-trade in favor of foodgrains is likely to result in reduced aggregate saving. If marginal propensity to save of agricultural entrepreneurs shifts upward as a result of changes in consumer and saving behavior the relationships noted here between terms-of-trade and savings may not hold good. This may be true if the use of new technology coupled with infrastructure makes private investment in the dynamic agricultural sector highly profitable. It is also important to recognize the effects of the shift of income arising out of the shift in domestic terms-of-trade on public saving. Public authorities find it relatively less difficult to tax the organized manufacturing sector and more difficult to tax the farm sector. The likely effect is a reduced public saving also.

Reduction in public saving is not without its effects on the farm sector. Private investments within agriculture are very often complementary to public investment. Investments in irrigation, power and roads act as catalytic agents in inducing more private investments within agriculture. Even while a high price rise generates more investment capacity within the farm sector, private investments in improvement of land, acquisition of farm assets and farm machinery get discouraged if improvements in water supply, drainage channels slow down because of dwindling resources of the government available for such purposes.

Public saving tends to be less also because of the consequences that high foodgrain prices have on government budgets. A significant part of public expenditure in developing countries is on salaries of employees, and when foodgrain prices rise the governments are forced to pay compensatory dearness allowances. Resources which could be used for investments within agriculture get diverted to payment of higher salaries so as to enable the employees to maintain their living standards. Dwindling tax resources, combined with increased current expenditures and payments of salaries push the governments to resort to increased money supply. An inflationary spiral

starts, which the governments are usually unable to control, with damaging consequences on overall economic growth.

The effect of high foodgrain prices on the cost structure of the agricultural economy, and in turn on the overall economy is also one of the less recognized factors in discussions of output price policies on growth of foodgrain production. In total cost of cultivation, hired labor forms a crucial element. With increasing commercialization, wage payments tend to be made in cash instead of in kind. High foodgrain prices affect not only the industrial workers but also the agricultural workers who form the poorest sections of the rural community. Though they have no unions, money wages tend to move with foodgrain prices though often with a lag. Since agricultural workers have the least capacity to bear any further decline in real wages, work efficiency is bound to suffer if there is any significant lag. A rise in the money wages of the agricultural laborers raises costs not only in the foodgrain sector, but also in the non-foodgrain agricultural sector. The result could be a further plea for rise in prices with cumulative effect on price spirals.

The effects of foodgrain prices on the distribution of income ^{5/} depend mainly on the status of the sellers of foodgrain producers vis-a-vis the buyers of foodgrains, how dispersed is foodgrain production and sale, whether concentrated in a few regions or more widely diffused over the country. It has a class dimension as well as a space dimension. The usual dichotomy between sectors -- agricultural and non-agricultural, urban and rural -- fails to grasp the complexity of the problem, and therefore misses the nature of conflicts generated. There is a confusion between number of producers and quantity produced, between production and sales. Within the agricultural sector, not all are producers. Even among the producers, not all sell, and even among sellers, quite a large proportion repurchase from the market after the harvest season. Moreover, the quantity sold is not evenly distributed; the bulk of it may be sold by a small proportion of farmers. The rising market dependence of the poor results in a situation in which rural buyers far outnumber urban buyers, reducing the thrust of the arguments that lowered foodgrain prices reflect an "urban bias." ^{6/} It is also not correct to say that high foodgrain prices benefit the rural poor as against the urban rich. Foodgrains form only a small part in the consumption budget of the rich, whether urban or rural, though the quantity consumed by this class in per capita terms is higher. At least one study in India shows that there is a far greater proportion of "poor" in the urban areas than in the rural. ^{7/}

^{5/} For the relation between prices and income distribution, see Mellor [11].

^{6/} For the question relating to incentives and disincentives as well as urban bias debate, see Dantwala [3].

^{7/} See Dandekar and Rath [2].

The spatial implications of foodgrain price policy assumes considerable importance in big countries among the "high food-drain economies." In these countries foodgrain surpluses tend to be concentrated in certain regions with better irrigation facilities, and foodgrain deficits are in regions with poor rainfall and susceptibility to drought conditions. The producers themselves have to depend upon the market during bad years and there is a double squeeze in these regions which suffer not only due to a fall in production but also due to a rise in prices. The worst hit are the small producers and the laborers in such regions. The ultimate effects depend upon the cumulative significance of these several variables both in relation to the regional and spatial dimensions. Simplistic statements that high foodgrain prices promote the interests of poor peasants and raise rural welfare ignore the complex realities.

Favorable terms-of-trade for foodgrain agriculture could be expected to have positive effects on foodgrain production but negative effects on aggregate saving through effects on inter-sectoral resource transfers and on the budgetary resources of the government. The positive effects on foodgrain production have effects on national income and through this route some positive effects on saving. But the net effects of terms-of-trade depend upon (i) any direct negative effects on aggregate and sectoral saving and this may in turn reduce investment supporting foodgrain production, and (ii) indirect positive effects on saving via its positive effects on raising foodgrain production. It is the net effects which are relevant in policy considerations.

The dynamics of the system and its quantitative relationships are analyzed empirically by using aggregate time series data from India. The analysis is conducted in two levels. First, the behavior of foodgrain prices, manufacturing prices and terms-of-trade are analyzed statistically. The estimated relationships for foodgrain and manufacturing prices are compared with each other. Secondly, the direct and indirect impact of terms-of-trade on domestic savings and foodgrain production is quantified so as to analyze the net effect of changes in terms-of-trade on the overall economy.

III. Empirical Analysis of the Linkages Between Prices and Growth

The purpose of this section is (a) to outline the economic model and (b) to analyze empirically the major components of the general framework examined in the preceding section.

3.1 The Economic Model:

The economic model in general form and the interrelations among its components are presented in the following six equations.

$$(1) Y_N = F_1 (F_N),$$

$$\frac{dY_N}{dF_N} > 0,$$

$$(2) F_N = F_2 (R_T, S_N),$$

$$\frac{\delta F_N}{\delta R_T} > 0, \quad \frac{\delta F_N}{\delta S_N} > 0,$$

$$(3) S_N = F_3 (R_T, Y_N),$$

$$\frac{\delta S_N}{\delta R_T} < 0, \quad \frac{\delta S_N}{\delta Y_N} > 0,$$

$$(4) R_T = F_4 (F_P, F_M, I_P),$$

$$\frac{\delta R_T}{\delta F_P} < 0, \quad \frac{\delta R_T}{\delta F_M} < 0, \quad \frac{\delta R_T}{\delta I_P} > 0,$$

$$(5) P_F = F_5 (F_P, F_M, M),$$

$$\frac{\delta P_F}{\delta F_P} < 0, \quad \frac{\delta P_F}{\delta F_M} < 0, \quad \frac{\delta P_F}{\delta M} > 0,$$

$$(6) P_M = F_6 (I_P, M),$$

$$\frac{\delta P_M}{\delta I_P} < 0, \quad \frac{\delta P_M}{\delta M} > 0,$$

where Y_P = national income, F_N = foodgrains production, P_F = foodgrain prices, S_N = national savings, R_T = domestic terms-of-trade (P_F/P_M), F_P = per capita production of foodgrains ($=F_N/P$), F_M = imports as proportion of procurements, P_M = manufacturing prices, I_P = industrial production, M = money supply and P = total population. 8/ All the dependent and independent variables refer to the current time period.

8/ The detailed definition of each of these variables is given in the Appendix.

Before analyzing the determinants of the trend, all the six variables discussed above were subject to trend analysis. The purpose was to determine if there was any trend and to calculate time rate of change and linear growth rate. For each of the variables discussed above, linear trend equations of the following form were fitted.

$$(7) Y = a + b T,$$

where Y is the independent variable, T is time period and a, b are the regression coefficients. b refers to annual time rate of change. The linear annual growth rate is obtained by dividing b with arithmetic mean of Y.

All the equations with significant trend were then estimated in both linear and log-linear forms by using ordinary least square and time series data (1952-53 to 1973-74) from India on each of the above variables. ^{9/} Only log-linear equations are reported in the subsequent analysis since they performed relatively better and gave elasticity estimates directly. The general log-linear model which corresponds to the estimated equations, can now be expressed below.

$$(8) \log Y_j(t) = \log b_{oj} + b_{ij} \log X_{ij}(t) + \dots + b_{nj} \log X_{nj}(t),$$

where $\log Y_j(t)$ is j^{th} independent variable in time t, $\log X_{ij}(t)$ is i^{th} dependent variable in j^{th} equation in time t and b_{ij} are regression coefficients which correspond to elasticities.

Both the linear trend equations and log-linear structural equations were estimated separately for (i) phase 1 from 1952-53 to 1964-65, (ii) phase 2 from 1965-66 to 1973-74, and (iii) the entire period from 1952-53 to 1973-74. Phase 1 and phase 2 correspond to pre-technology and post-technology periods, respectively. However, the results reported in the subsequent analysis refer mainly to the entire period. The linear trend and log-linear structural equations along with their interpretations are analyzed below. ^{10/}

^{9/}The time series data is either obtained directly or derived from Government of India publications [6, 7, 8].

^{10/}The empirical analysis indicates that there was autocorrelation in the trend equations for foodgrain prices, manufacturing prices and terms-of-trade. Since the trend analysis was not the main focus of this study and that trend variable in all the equations was highly significant, no effort was made to eliminate autocorrelation. In structural equations for foodgrain prices and terms-of-trade the test was inconclusive. There was no autocorrelation in the structural equations for manufacturing prices, savings, foodgrain production and national income.

3.2 Behavior of Prices and Terms-of-Trade

Estimation of trends and the determinants of foodgrain prices, manufacturing prices and terms-of-trade are reported in Table 1. The index of foodgrain prices during the period under study has been increasing at the annual rate of 9.02 index points and 6.2 percent annual growth rate (equation 1.1). But when the period is sub-divided into two phases ^{11/} a distinctly higher annual rate of increase is noticed in the second phase as compared to the first, nearly six times greater, an explosive increase.

The behavior of the foodgrain prices (equation 1.2) is explained in terms of three variables, namely (i) per capita foodgrain production, (ii) the ratio of imports to procurement, and (iii) money supply. The choice of the second variable requires explanation. Procurement not only enables the government to acquire stocks for public distribution but these operations are to ensure that foodgrain prices do not fall below particular levels during the post-harvest season. During periods of increased supplies, procurement serves to make the minimum support price effective. On the other hand, imports augment supplies and have a depressing effect on foodgrain prices. For these reasons as the ratio of imports to procurement increases, given domestic production, foodgrain prices could be expected to fall and vice-versa. Consequently, it serves to capture the market psychology of sellers and buyers in price formation and market arrivals in response to government operations with respect to procurement and imports of foodgrains. ^{12/} Foodgrain prices are expected to move positively with money supply and negatively with per capita domestic production.

The estimated function shows that the regression coefficients have the expected signs for all the three variables. Both per capita foodgrain production and ratio of imports to procurement show negative coefficients and money supply a positive coefficient. But of the three variables, only money supply is found to be statistically significant. It would appear surprising that per capita foodgrain production should not be found statistically significant in explaining the price behavior of foodgrain prices. A little reflection shows that this is not that surprising. In economies in which there is a significant proportion of production for home consumption and the income elasticity of demand for home produce is high, increased supplies have an effect not only on the supply side, but also on the demand side. Peasants, especially small and marginal, increase their own consumption when their supplies increase, though not at the same rate. Furthermore, farmers have a tendency to engage in inventory building in good years and its

^{11/} For empirical analysis of trends in foodgrain prices and terms-of-trade up to the period of 1964-65, see Dar [5], Mellor and Dar [12] and Tamarajakshi [16].

^{12/} This has been discussed by Chaudhri [1] in the context of wheat. For further details and general discussion on price formation and the dilemmas of marketable surplus, see Parthasarathy [14].

Table 1. Results for Foodgrain Prices, Manufacturing Prices and Terms-of-Trade
(N = 22)

Eq. No.	Dependent variable	Constant	Log constant	Independent variables				\bar{R}^2	F	d
				T	log F_P	log F_M	log I_P			
1	P_F	*** 42.727 (12.261)		*** 9.020 (0.934)				0.82	*** 93.35	0.52
2	log P_F		* 5.178 (2.692)		-0.497 (0.487)	-0.054 (0.054)		0.89	*** 56.00	1.02
3	P_M	*** 69.364 (7.122)		*** 6.632 (0.542)				0.88	*** 149.62	0.29
4	log P_M		*** 3.836 (0.262)				*** -0.233 (0.074)	0.89	*** 841.60	1.38
5	R_T	*** 79.623 (5.685)		*** 1.551 (0.433)				0.36	*** 12.83	0.82
6	log R_T		** 7.108 (2.723)		-0.669 (0.470)	-0.077 (0.048)	* 0.232 (0.131)	0.27	** 3.57	1.03

Notes: 1. *** = > P = 0.01, ** = > P = 0.05, * = > P = 0.10

2. Regression coefficients refer to elasticities.

3. Figures within the parentheses refer to standard errors of regression coefficients.

4. \bar{R}^2 refers to R^2 adjusted for degrees of freedom.

depletion in bad years. For these reasons foodgrain prices could be expected to be less responsive to supplies than what one would expect otherwise. Further, government attempts which seek to ensure that foodgrain prices move within a certain range of minimum and maximum prices, however imperfect these attempts are, will also contribute to the observed non-significance of the responsiveness of prices to foodgrain production. The decisive influence of money supply on foodgrain prices is known and could be expected. A one percent rise in money supplies increases foodgrain prices by around 0.7 percent.

The trend in manufacturing prices is estimated in equation 1.3. The overall annual rate of rise of manufacturing prices is 6.63 index points (4.6 percent growth rate) and is found to be nearly two-thirds the annual rate of rise observed in the index for foodgrain prices. But examination of the period by subdividing it into two phases shows a distinct pattern in relation to trends in foodgrain prices. During the first phase, manufacturing prices increased at an annual rate greater than foodgrain prices. But in the second phase, the rates for the two prices were almost identical. However, the annual growth rate for manufacturing prices was high in both phases. The greater increase in foodgrain prices, as compared to manufacturing prices, over the entire period were due mainly to large discrete jumps in the foodgrain prices as we move from phase 1 to phase 2.

The behavior of manufacturing price is explained in terms of (i) an index of manufacturing commodities in per capita terms, and (ii) money supply (equation 1.4). Prices are expected to move negatively with per capita manufacturing production and positively with money supply. Both the regression coefficients have expected signs and are statistically significant. A one percent rise in the index of manufacturing commodities in per capita terms shows a fall in prices by 0.2 percent while a one percent increase in money supply increases the price by 0.6 percent. If manufacturing prices are to be stable when money supplies increase by one percent, a three percent increase in manufacturing production would be required.

That there are differences in the significance of per capita supplies for explaining respective price behavior for foodgrains and manufacturing commodities is interesting and needs to be analyzed. With respect of foodgrain prices, per capita production is statistically non-significant while with respect of manufacturing prices it is statistically quite significant. Two factors in particular can explain this: the dual effect of production in the case of foodgrain increases both influencing supplies and generating demand via income effects; and the greater role of the government with respect to the range within which foodgrain prices could move.

The terms-of-trade is found to rise at an annual rate of 1.55 and annual growth rate of 1.6 percent for the entire period (equation 1.5). Here again looking at the entire period does not adequately bring out the character of the trend as the trend obscures the dramatic shift, seen when the period is sub-divided into two phases and the respective trends are examined. Each phase taken singly shows negative coefficients (though in both periods the coefficients are statistically non-significant) while the overall period shows a significantly positive coefficient suggesting favorable terms-of-trade. The distinct pattern for the overall period is due

primarily to a discrete jump as we move from the first phase to the second. An upward shift in the terms-of-trade in the second phase with a downward movement in both the phases needs to be noted, however. The trend in terms-of-trade is explained in terms of three variables: (i) foodgrain production in per capita terms, (ii) the ratio of imports to procurement, and (iii) production of manufactured commodities in per capita terms.

The signs of the regression coefficients (equation 1.6) turn out to be those expected for all three variables. But of the three, only industrial production per capita is statistically significant. A one percent increase in this moves the terms-of-trade in favor of foodgrains by 0.2 percent, because of its negative effect on manufacturing prices. But the explanatory power of the function is found to be weak as seen from R^2 , which is low.

3.3 Terms-of-Trade, Savings and Economic Growth

As suggested earlier, changes in terms-of-trade influence the level of savings. The other important variable that influences the level of savings is the income. ^{13/} The results are reported in Table 2. The trends in domestic savings are estimated for the entire period (equation 2.1). Savings have risen at an annual rate of 0.73 billion, at a rate of 5.3 percent annually as against 3.3 percent rise annually in national income. The implied marginal propensity to save is higher than the average propensity.

The behavior of savings is related in equation 2.2 to (i) terms-of-trade, and (ii) national income. A favorable change in terms-of-trade for foodgrains is expected to have adverse influence on savings, as was explained earlier, while savings is expected to have a positive relationship with national income. The signs of the regression coefficients are as expected. Both the coefficients are found to be statistically significant. A one percent shift in terms-of-trade in favor of foodgrain prices shows a 1.1 percent decline in the level of savings while a one percent increase in national income shows a 2.2 percent rise in savings. It would take a 0.49 percent rise in national income to compensate the adverse effects of one percent change in terms-of-trade on domestic savings. If the terms-of-trade have a favorable influence on foodgrain production coupled with the positive relationship between foodgrain production and national income, this could well happen.

Trends in foodgrain production are estimated for the entire period (equation 2.3). The index rises at the rate of 1.6, the percent annual rate being 2.0 percent. The long-term trend in foodgrain production approximated the rate of growth of population or is slightly below it. Two variables, namely (i) terms-of-trade and (ii) saving, are chosen to explain the

^{13/} It will be more useful to break down aggregate savings into agricultural sector, industrial sector and public sector savings, especially in the context of analyzing the saving behavior of industrial entrepreneurs and sellers of foodgrain products. However, non-availability of data does not permit disaggregate analysis.

Table 2. Results for Aggregate Savings, Foodgrains Production and National Income in India (N = 22)

Eq. No.	Dependent variable	Constant	Log constant	Independent variables					\bar{R}^2	F	d
				T	log R_T	log Y_N	log S_N	log F_N			
1	S_N	*** 5.438 (1.054)		*** 0.728 (0.080)					0.79	*** 82.16	1.00
2	log S_N		*** -3.542 (0.868)		*** -1.072 (0.227)	*** 2.209 (0.166)			0.90	*** 96.00	1.96
3	F_N	*** 54.340 (2.521)		*** 1.617 (0.192)					0.77	*** 70.96	1.51
4	log F_N		*** 2.205 (0.541)		*** 0.306 (0.122)		*** 0.265 (0.046)		0.70	*** 25.38	1.47
5	Y_N	*** 90.722 (1.825)		*** 4.942 (0.139)					0.98	*** 1265.01	1.47
6	log Y_N		-0.407 (0.557)					*** 1.257 (0.130)	0.82	*** 93.47	1.31

Notes: Same as for Table 1.

trends in foodgrain production. Foodgrain production is expected to move positively with terms-of-trade as well as savings. The expected relationship between terms-of-trade and foodgrain production is obvious and needs no further explanation. Savings is expected to have a positive relationship with foodgrain relationship mainly through enhancing the capacities of public authorities to invest in irrigation, power, fertilizers and agricultural infrastructure and by increased capacities of the peasants to undertake investment in agriculture. The regression coefficients of both have the expected signs and are found significant. A one percent increase in terms-of-trade in foodgrains increases foodgrain production by 0.31 percent. By implication a three percent increase in foodgrain production would call for a rise of 9.7 percent shift in terms-of-trade of foodgrains. On the other hand, a one percent increase in savings would raise foodgrains production by 0.27 percent.

What needs to be recognized is that the terms-of-trade will have both positive and negative effects. On the positive side it induces increases in foodgrain production. On the negative side are its direct effects depressing aggregate savings through increases in foodgrain production and the effects of this on national income, there could be some compensatory positive effects too. The policymaker needs to assess the combined effects before he chooses to try to raise foodgrain production through improving the terms-of-trade rather than making direct investments in agriculture. To understand factors involved and the linkages we pursued the analysis further using Indian data.

A simple log-linear function between national income and foodgrain production is estimated. The regression coefficient has the expected positive sign and is statistically significant. The elasticity of national income with reference to foodgrain production is found to be 1.3. Using this estimate we could now see the combined effects of terms-of-trade on saving. A one percent shift in terms-of-trade brings about 0.31 percent increase in foodgrains production, 0.38 percent in income, and 0.85 percent increase in saving. On the other hand it brings about a decline of 1.07 percent in saving, bringing about a net decline in the level of savings, which is neither good for agriculture, nor for overall growth.

Even though both terms-of-trade and savings have positive effects on foodgrain production, the sources of increased production differ in both cases. The effects of favorable terms-of-trade are more of short run nature which are brought about through changes in cropping pattern, increased use of variable inputs and better management. On the other hand, investment in agriculture, whether private or public, increases potential for growth in foodgrains production in the long run through the development of new technology, land development, irrigation expansion and drainage, use of fixed capital and public investment to produce inputs used in the agricultural sector. It is these effects which are more desirable for growth in foodgrain production in the long run. To the extent favorable terms-of-trade induce private investment in agriculture it also increases long run potential for growth.

The equations estimated above are description of historical series in India and may not be appropriate for making accurate predictions for the respective variables. Implicitly, it is assumed that all the savings are translated into productive investment. It is no different than the assumption made in most of the economic growth literature and approximates the real world domestic saving and investment relations at the aggregate level. Finally, the model results and Five Year Plan investment outlays in India indicate that a significant part of public investment went to the agricultural sector directly or indirectly, leading to an increase in the production potential. However, if in the future the share of public investment in the agricultural sector declines it will have a depressing effect on both the production potential and inducement for private investment. Under such circumstances it will increase the dependence of the policymaker on foodgrain prices as a tool to expand foodgrain production through changes in the cropping pattern in favor of foodgrains and by inducing private investment. This may support the arguments put forth by the price enthusiasts despite its dampening effects on the welfare of the weaker sections in the society.

IV. Summary and Conclusions

High prices for foodgrains are advocated by some not only to induce more production but in terms of overall growth, distribution of income and welfare. While the role of favorable terms-of-trade for foodgrains in general, and the terms-of-trade in relation to input prices in particular, can be seen as inducing growth in production and appears to have a valid empirical basis, policy solutions based on the observed relationship between terms-of-trade and foodgrain production neglect the implications of this in relation to overall growth and distribution of income and welfare. The problem of distribution of income and welfare is much more complex, and the effects of shifting terms-of-trade on these could be assessed only if extensive and specific data on the composition of sellers and buyers by income groups are available. The spatial distribution of effects is no less important. It was, however, possible to examine the implications of shifting terms-of-trade in relation to growth, as judged by its effects on overall savings and national income based on Indian data.

This paper was restricted to an examination of the dual effects of shifting terms-of-trade on (a) foodgrain production and (b) overall growth as judged by the aggregate level of savings, with an assessment of the combined effects on growth. Terms-of-trade were found to have a positive effect on foodgrain production, but with a negative effect on aggregate savings. Via positive effects of foodgrain production, they had positive effect on national income and thereby a positive effect on saving. The net effect on savings of favorable terms-of-trade for foodgrain production is found to be negative. Shifting the terms-of-trade in favor of foodgrain production is only one instrument available to policymakers, and its efficacy in relation to other instruments, such as direct public investments in agriculture, continues to be an open question. Policymakers in developing countries should not be

blamed if they do not eagerly accept the policy advice of "positive pricing" enthusiasts. Though the conclusions of this paper are based on Indian experience, they may have a wider relevance to the policy options available to other developing countries also.

References

1. Chaudhri, S. C., "Market Arrivals and Price of Wheat," Agricultural Situation in India, August 1960, pp. 465-68.
2. Dandekar, V. M. and N. Rath, "Poverty in India," Economic and Political Weekly, Vol. VI (10), January 2, 1971.
3. Dantwala, M. D., "Incentives and Disincentives in Indian Agriculture," Indian Journal of Agricultural Economics, Vol. 22 (2), April-June, 1967, pp. 1-25.
4. Dantwala, M. L., "Introduction" in ISAE, Agricultural Development in Developing Countries - Comparative Experience, Indian Society of Agricultural Economics, Bombay, 1972.
5. Dar, A. K., "Domestic Terms of Trade and Economic Development in India, 1952-53 to 1964-65," Cornell International Agricultural Development Bulletin No. 12, 1968.
6. India, Government of. Ministry of Food and Agriculture, Directorate of Economics and Statistics, Bulletin of Food Statistics (1952-1974), New Delhi.
7. _____. Indian Agriculture in Brief (1965-1973), New Delhi.
8. _____. Economic Survey (1965-1975), New Delhi.
9. Krishna, Raj, "Agricultural Price Policy and Economic Development," in H. M. Southworth and B. F. Johnston (eds.) Agricultural Development and Economic Growth. Ithaca: Cornell University Press, 1967, pp. 497-540.
10. Mellor, John W., "The Functions of Agricultural Prices in Economic Development," Indian Journal of Agricultural Economics, Vol. 23 (1), January-March, 1968, pp. 23-37.
11. _____. "Agricultural Price Policy and Income Distribution in Low Income Nations," paper presented at the Colloquium on Agricultural Price Policy, Cornell University, February, 1976.
12. Mellor, John W. and A. K. Dar, "Determinants and Development Implications of Foodgrain Prices in India, 1949-1964," American Journal of Agricultural Economics, Vol. 50 (4), November, 1968, pp. 962-974.
13. Narain, Dharm, "Agriculture Drags India Back," The Round Table, No. 230, April, 1968, pp. 187-193.
14. Parthasarathy, G., "Dilemmas of Marketable Surplus: The Indian Case," paper presented at the Colloquium on Agricultural Price Policy, Cornell University, February, 1976.

15. Schultz, T. W., The Economic Organization of Agriculture. New York: McGraw-Hill, 1953.
16. Tamarajakshi, R., "Intersectoral Terms of Trade and Marketed Surplus of Agricultural Produce, 1951-52 to 1965-66," Economic and Political Weekly, Vol. IV (26), June 28, 1969, pp. A91-A101.

Appendix

Definition of Variables

Number	Symbol	Description
1	T	Time trend (1, 2, ...,22)
2	P _F	Indices of wholesale prices of food-grains (1952-53 = 100)
3	P _M	Indices of wholesale prices of manufacturing (1952-53 = 100)
4	R _T	Terms-of-trade between the indices of wholesale prices of foodgrains and manufacturers
5	Y _N	National income in billion rupees
6	S _N	National domestic savings in billion rupees (1960-61 prices)
7	F _N	Domestic net (gross minus 12.5 percent of gross) production of foodgrains in million tons
8	F _P	Average annual per capita net domestic foodgrains production in kilograms
9	F _M	Imports as percent of domestic procurements of foodgrains
10	I _P	Index of per capita industrial production (1952-53 = 100)
11	M	Money supply in billion rupees

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