GROWTH LINKAGES OF THE NEW FOODGRAIN TECHNOLOGIES

By

John W. Mellor

Uma J. Lele

May, 1972 No. 72-4

TABLE OF CONTENTS

LIST OF TABLES

GROWTH LINKAGES OF THE NEW FOODGRAIN TECHNOLOGIES

John W. Mellor
Uma J. Lele*

I. Introduction

Successful introduction of the new high-yielding foodgrain varieties makes a substantial net addition to national income and distributes that income largely to upper-income rural people. Since upper-income rural people have a low marginal propensity to consume food grains, an initial imbalance is created between increased foodgrain supply and demand. The very forces which lie behind this imbalance provide potential for growth and employment stimulating linkages with other sectors of the economy. Through these linkages, supply and demand for food grains may be balanced with only a small change in relative prices. Failure to develop these linkages may result in large changes in relative foodgrains prices which could prejudice continued growth of the foodgrains sector itself.

In most low-income economies, the laboring classes spend a larger proportion of added income on food grain than on any other commodity. For this reason, it is unlikely that employment and income of the poor can be increased successfully without expanded food grain supply (17). Likewise, it is difficult to improve domestic demand for food grain without increasing employment and income of the poor. Thus, in the context of technological breakthroughs that greatly increase foodgrain supply, there is potential unity between the desire of the rural rich for expanded foodgrain markets and of the rural poor for greater employment (16). The linkage of these interests is complex.

---

* The authors are respectively at Cornell University and the World Bank. The views stated are those of the authors and do not necessarily express the views of the World Bank. The authors are greatly indebted to Bhupendra Desai for analysis of the income distribution and expenditure data, to Uttam Dabholkar for developing the data on capital-labor ratios, to Debra Allen for work on the same data, and to Roger Selley, Doyle Eiler and Viet Burger in developing the simulation model. An early version of this paper, entitled, "Domestic Markets and the Growth of Farm Cash Income," was presented at a conference on "Agricultural Strategies for the 1970s: Their Design and Implementation," Food Research Institute, Stanford University, December 13-18, 1971.

Their low marginal propensity to consume food grain causes the upper-income peasants to market a high proportion of increments to production. That marketed surplus provides the wages-goods necessary to support expanded employment in other sectors. It also provides the cash income for purchase of the output of other sectors which in turn increases employment for the laboring classes. That employment expands the demand for food grains.[1/] In neither theory nor practice do these relationships necessarily provide equilibrium at high levels of employment growth nor maintenance of price relationships favorable to rapid growth of foodgrains production.

The size of the linkage between growth in foodgrain production and production and employment in other sectors depends on both the size and the distribution of the production increase. These are highly varied functions of the nature of the new technologies and the environment within which they are applied. Given the production increase and distribution, there are still complex interactions between marketing of the increased production, expanded employment in other sectors, the capital-labor ratios in production in those sectors, the change in real wage rates and average income of the laboring classes, and the terms of trade between the foodgrain and nonfoodgrain sectors. We have previously explored these complex relationships in the context of a general equilibrium model for a dualistic economy in terms of the food and labor markets (21). That model explicitly incorporates biased technological change in foodgrains production and as a result describes more realistic and complex relationships than do other dualistic models.

In this paper we explore several of the empirical relationships suggested by our formal model. We present data with respect to the initial distribution of income from the new foodgrain technologies and the expenditure pattern of that income. These data indicate the effect of different distributions of benefits from new technologies on the marketings of food grains and on the structure of demand for other commodities. We also examine the capital-labor ratios in various manufacturing industries as an indicator of the employment implications of various expenditure patterns. Finally, we present preliminary results from a simulation model which analyzes the relationship between foodgrain production and employment. We purposefully explore the broad ramifications of the subject and present illustrative data on several parts of the process. The areas and relationships we examine require more intensive analysis if sound growth and distribution policy is to follow. We hope our presentation will stimulate that effort.

1/ Note that increased incomes in rural areas achieved through higher relative output prices, largely represent transfer of income among sectors rather than net increase in national income. The positive growth linkage arising from expenditure of such increase in rural incomes tends to be balanced by the linkages with reduced income in the sectors from which the income was transferred (19).

II. The Direct Distribution of Income from the New Foodgrain Technologies

The nature of technology and the environment within which it is applied determine yield increase, quantity of inputs purchased and employment content. These, in turn, determine the distribution of benefits among various income classes. There is great variability in these effects, partly because of variability in the technical characteristics of innovation, and largely because of variability in the environment within which they are applied. The new high-yielding foodgrain varieties typically generate small increases in demand for labor and in income of the laboring classes, and large increase in yields and in net income of the cultivator classes.[2/] The problems and potentials are well illustrated by the high-yielding dwarf wheat varieties.

Introduction of the new wheat varieties in Aligarh District, India illustrates the relationship for an unusually productive new variety with a larger than average employment component. In this case, yields per acre nearly doubled, considered normal for the new dwarf wheat varieties (Table 1). The lower unit price of the new variety is reflected in an increase in gross income of only 71 percent. Because purchase of inputs rose less than proportionately to gross income, the net return to the cultivator's family labor, capital and land rose 80 percent. This is a rough measure of the increased income received by the landowning cultivator class. The extent to which this class uses family labor or hired labor varies considerably. In this case, even if all the additional labor were hired, the return to the owner's family labor and capital would still have increased by 80 percent.

The total labor use in cultivation of new wheat varieties on these farms rose by nearly 60 percent. This increase was divided into a 68 percent rise in family labor use and a 37 percent rise in hired labor use. Thus, assuming constant wage rates, the percentage increase in income of laborers is less than half as great as that of the landowning class. The distribution to the laboring class also depends on the distribution of employment between farm family and hired labor. If all the labor had been hired, then laborer's incomes would have risen by three-quarters as great a percentage as land-owner's incomes.

The disparities in absolute increments to income are much more striking than the percentage changes. Assuming that the typical farm operator transfers ten acres of wheat from traditional to modern varieties, he increases his family income by Rs. 3450. Assuming that

---

2/ In our formal model, we simplified to a dichotomy of landowners and laborers. However, as long as there is inequality in land owned per farmer, there will be unequal distribution of the benefits of biased technological change and the relationships depicted by the model will hold.

TABLE 1. Division of the Increased "Payments" from a High-Yielding Wheat Variety, Aligarh District, U.P. India, 1967-68.

Item	Traditional variety	High yielding variety	Percent increase
		(Quintals)	
1. Yield	7.5	14.8	96
		(Rupees)	
2. Gross value of production	653	1115	71
3. Payments (costs) other than family labor, land & capital	219	334	52
4. Payments for fertilizer (included in 3)	37	76	110
5. Payments (net return) to family labor, land & capital	434	781	80
6. Payments (net return) to family land & capital	380	690	82
7. Payments to labor (cost or imputed value)	80	126	59
a. Family labor	54	91	68
b. Hired labor	26	35	37

	Increments in shift from traditional to high-yielding variety	
	Rupees per acre	% of increment to gross production
8. Gross value of production (row 2)	462	100
9. Payments to labor (row 7)	46	10
10. Payments (returns) to all inputs, including land & capital, but excluding labor (row 2 minus row 7)	416	90
11. Payments (costs) other than labor (row 3 minus row 7b)	106	23
12. Payments for fertilizer (row 4) (included in 11)	39	8
13. Payments (net returns) to family land and capital (row 6)	310	67

Source: Adapted from R. S. Dixit and P. P. Singh, "Impact of High Yielding Varieties on Human Labor Inputs," Agricultural Situation in India, Vol. XXIV, No. 12, March, 1970.

the typical laborer had a base income of Rs. 750 per year, consistent with the lower three deciles in the Indian distribution of family expenditure, and that the increase in employment is 37 percent, as above, then his income increases by only Rs. 278. This is only 8 percent as great as the increase received by the owner-cultivator class. If we assume that all the added labor is hired, then the increment to the laborer's income is about Rs. 450. This is still less than 15 percent of the increase in income of the owner-cultivator class. In such a situation, social discontent arises not because the condition of the laboring class is worsened in absolute terms, but because they receive such a small proportion of the incremental benefits.

This point can also be noted somewhat differently. Labor receives only Rs. 46, or 10 percent of the Rs. 462 increase in gross income per acre from the high-yielding variety. Ninety percent, or Rs. 416, is added payment to other factors. Eight percent of gross income goes as payment for purchased fertilizer and 14 percent is payment for other costs, such as bullock labor, seeds and farm manure. Thus, 67 percent of the increased gross income is added payment to the family land and capital.

A ten percent labor share of increased production from high-yielding varieties is typical. Out of the 14 cases in Table 2, eleven show an incremental share to labor of between 5 and 15 percent. However in one case, that of the Gumai Bil in Bangladesh, labor use almost doubled, and labor's share from the increment to production was 32 percent. In this case a very large increase in yields and highly labor intensive cultural and harvesting techniques resulted in a large increase in labor use. In contrast, in an area in the Philippines where yields per acre increased 70 percent, only three percent of the increased production went to labor. However, because of a decline in use of family labor and an increase in hired labor, ten percent of the increment in production went to hired labor.

It is clear that the extent to which low-income laborers share in increased production is fragile. On the one hand, increase in employment may be divided differently between the family labor of the farm operator and hired labor. On the other hand, even slight mechanization may eliminate an increase in employment. This is particularly likely when the increase in labor requirements is concentrated at seasonal peaks.3/

III. Growth Linkages Through Consumption Expenditure

Agriculture is commonly thought to have weak growth stimulating

---

3/ The interesting interaction of new varieties, increased intensity of farming and mechanization is discussed in (3).

TABLE 2. Division of Increased "Payments" Between Labor and Other Inputs, Various High-Yielding Varieties and Areas.

Area	Increase in gross value of output		Increase in labor "payments" of		Percent increased output to labor[a]	Percent increased output to other inputs[b]
	Rupees per acre	Percent increase	Rupees per acre	Percent increase		
Wheat						
Aligarh, U.P. (7)	462	71	46	58	10	90
Varanasi, U.P. (24)	620	65	11	15	2	98
Udaipur, Rajasthan (1)	343	43	18	13	5	95
Punjab (14)	450	100	56	42	12	88
Kharif paddy						
West Godavari, Andhra Pradesh (2)	269	38	32	17	12	88
East Godavari, Andhra Pradesh (2)	216	33	20	13	10	90
Uttar Pradesh (24)	1100	200	67	92	6	94
Tamil Nadu (13)	550	100	33	20	6	94
Laguna, Philippines (4)	374	72	3	3	1	99
Sambalpur, Orissa (28)	404	95	36	28	11	89
Rabi paddy						
West Godavari, Andhra Pradesh (2)	562	86	39	16	7	93
East Godavari, Andhra Pradesh (2)	761	153	39	30	5	95
Tamil Nadu (13)	625	100	46	21	7	93
Gumai Bil, Bangladesh (18)	948	208	302	125	32	68
Bajra						
Kaira, Gujarat (5)	300	85	39	27	13	87

[a] Labor "payment" is defined as physical labor input (family and hired) in man-days at a constant wage.

[b] Other inputs "payments" defined as gross value of output minus share to labor.

Source: Adapted from references as indicated in parentheses.

linkages (8, 9).[4/] Traditional agriculture uses few capital goods purchased from other sectors and the tendency of growth theory to focus on capital withholds attention from agriculture's substantial purchases of nonagricultural consumer goods. In contrast, the new foodgrain technologies normally require increased purchase of current inputs and may stimulate greater purchase of fixed capital goods from other sectors. Far more important, however, is the large increase in consumption expenditure which is likely to occur. It is the large aggregate increase in net agricultural income and consequent purchase of consumption goods which offers a large potential stimulus to other sectors.

For the case represented in Table 1, nearly 80 percent of the large gross increment to income is available for consumption expenditure by either the laboring or landowning classes. This is the case for a high-yielding variety noted for its large requirement of current inputs. Over one-third of the incremental current production expenditure, other than for labor, is for purchased fertilizer. Domestic growth linkages of inorganic fertilizer are likely to be weak, either because it is imported or because of its highly capital-intensive production techniques. The capital equipment for fertilizer production is likely to be imported and the low employment content allows little increase in demand for domestically produced consumer goods.

Introduction of high-yielding varieties may increase returns to fixed investments such as pumps and engines. Particularly in the initial periods of accelerated investment the linkage effects can be important. However, because of relatively low capital output ratios, even in dynamic equilibrium the linkage effect of increased investment is likely to be much less than that of increased consumption expenditure. Nevertheless, changing patterns of rural investment need to be studied more intensively since little data are available on these relationships and they are important to the time phasing of intra and inter-regional capital flows and to the cyclical pattern of capital goods production.

The pattern of consumption expenditure is of particular interest because it varies considerably from one income class to another. Thus, who receives increments to income has an important influence on the pattern of expenditure which may, in turn, influence the employment content of increased production. That, in turn, affects later linkages including the linkage back to the demand for food grains.

For this analysis we consider three major class of commodities -- food grains, other agricultural commodities, and nonagricultural commodities. These three classes differ substantially in both their consumption and

---

4/ E.g. see Hirschman's striking statement, "agriculture certainly stands convicted on the count of its lack of direct stimulus to the setting up of new activities through linkage effects - the superiority of manufacturing in this respect is crushing." (9, page 109-110).

production characteristics. The data used are drawn from India's consumer surveys.

Food Grains

Agricultural laborers in India, represented by the lower two deciles of expenditure class, spend over three-quarters of increments to consumption expenditure on agricultural commodities and 55 percent on food grains alone (Table 3). Thus, increasing foodgrains production through labor-using methods is a substantially self-balancing process. More labor is used in foodgrains production. Much of the increased output is paid to the laborers who will directly consume a substantial proportion of those payments. There is small effect on cash flows or stimulus to other sectors of the economy. Agricultural technology which distributes benefits to higher income rural people provides much more complex linkages.

In successively higher expenditure classes, the proportion of expenditure increments spent on food grains declines rapidly. Thus, for the sixth, seventh and eighth deciles, roughly representative of the dominant cultivator class, which in India, produces the bulk of agricultural output, only 15 percent of increments to expenditure are allocated to food grains (Table 3).[5/] Thus, these income groups presumably market food grains the equivalent of some 85 percent of the value of increments to expenditure. It is these marketings which provide the food supplies to sustain an increase in the labor force in the nonfoodgrain sectors. It is these sales which also provide the cash income to purchase the goods and services which the added labor can produce. The nature of the various equilibria and of consequent policy needs is determined by the composition of the remaining consumption allocations.

Nonfoodgrain Agricultural Commodities

Nonfoodgrain agricultural commodities comprise roughly 35 percent of incremental expenditure in all income classes except the lowest (Table 3).

5/ Identification of various expenditure classes by size of holding was done by using the National Sample Survey of land holdings and consumption expenditure for the year 1961-62. From the data on land holdings, the cumulative percentage distribution of rural population in various land holding groups was calculated. Similarly, from the data on consumption expenditure, the cumulative percentage distribution of rural population in various expenditure classes was calculated. The two cumulative distributions were then matched by inspection to find the approximate correspondence between the level of expenditure and land holding. The use of the cumulative distribution provided a basis to determine the level of expenditure and land holding in various deciles of the population. The average per capita expenditure in each expenditure class (and hence in the corresponding holding size) was weighted by the number of people in each class.

TABLE 3. Division of Incremental Expenditure Among Expenditure Categories, by Rural Expenditure Class, India, 1964-65.

	Bottom 2 deciles (mainly landless ag. & nonag. laborers)	3rd decile (laborers with less than 1 acre)	4th & 5th deciles (1-5 acres)	6th, 7th & 8th deciles (5-10 acres)	9th decile (10-15 acres)	Lower ½ of 10th decile (15-30 acres)	Upper ½ of 10th decile (30+ acres)
Mean Per Capita Monthly Expenditure	8.93	13.14	17.80	24.13	30.71	41.89	85.84
Allocation of an Additional Rupee of Expenditure							
A. Agricultural Commodities	0.78	0.69	0.59	0.51	0.43	0.42	0.34
(a) Food grains	0.55	0.36	0.24	0.15	0.10	0.07	0.02
(b) Nonfoodgrains	0.23	0.33	0.35	0.36	0.33	0.35	0.32
(i) Milk & milk products	0.08	0.11	0.13	0.13	0.12	0.12	0.09
(ii) Meat, eggs & fish	0.02	0.03	0.03	0.03	0.03	0.03	0.03
(iii) Other foods (a)	0.02	0.06	0.08	0.09	0.10	0.12	0.17
(iv) Tobacco	0.02	0.02	0.01	0.02	0.01	0.01	-
(v) Vanaspati	-	0.01	0.01	0.02	0.02	0.02	0.01
(vi) Other oils	0.05	0.05	0.04	0.03	0.02	0.02	0.01
(vii) Sweetners	0.04	0.05	0.05	0.04	0.03	0.03	0.01
B. Nonagricultural Commodities	0.22	0.31	0.41	0.49	0.57	0.58	0.66
(a) Textiles	0.09	0.08	0.09	0.10	0.07	0.06	0.08
(i) Cotton textiles	0.09	0.08	0.08	0.07	0.06	0.05	0.04
(ii) Woolen textiles	-	-	-	0.01	-	0.01	0.02
(iii) Other textiles	-	-	-	0.01	-	-	0.02
(b) Nontextiles	0.13	0.23	0.32	0.39	0.50	0.52	0.58
(i) Footwear	-	0.01	0.01	0.01	0.01	-	-
(ii) Durables & semidurables (b)	0.01	0.01	0.01	0.02	0.02	0.03	0.05
(iii) Conveyance (c)	0.01	0.01	0.02	0.02	0.04	0.05	0.10
(iv) Consumer services (d)	0.02	0.02	0.03	0.03	0.03	0.04	0.06
(v) Education (e)	0.01	0.01	0.02	0.03	0.03	0.05	0.11
(vi) Fuel & light	0.08	0.07	0.07	0.06	0.04	0.04	0.03
(vii) House rent (f)	-	0.01	0.01	0.02	0.03	0.04	0.08
(viii) Miscellaneous (g)	-	0.09	0.16	0.17	0.31	0.27	0.15
TOTAL	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Notes and References for Table 3

Source: The data are reported in a forthcoming paper (6, 26). The source is from the NCAER "All-India Consumer Expenditure Survey 1964-65." (24) These data provide expenditure elasticities of food grains and milk and milk-products consistent with those from the National Sample Survey of 1963-64 (16) when fitted to the function used here (26). R^2 for equations estimated for different commodities varied between .742 and .981. The regression coefficients were tested using the "t" test and many of them were found to be significant either at 5 percent or 1 percent levels. As compared to published NSS, the NCAER data provide more detailed breakdown of expenditure but for a sample biased toward higher income groups.

Mathematical Functional Form Used:

$$\log y = a + \underset{\underline{b}}{x} + c \log x$$

where y = per capita monthly expenditure on a commodity in each expenditure class
x = per capita monthly total expenditure in each expenditure class.

Definitions of Expenditure Categories:

(a) Other foods include spices, salt, vegetables, fruits and nuts, beverages, refreshments, jam, jelly, pickles.

(b) Durables and semidurables mainly include furniture, kitchen equipment, sewing machines, electric fans, transistor radios, radios, bicycles, motorcycles, motor cars, etc.

(c) Conveyance include expenses on transportation by bus, taxi, train, airplane, steamer, boat, motor car, motorcycle, scooter, rickshaw, bullock cart, horse cart, including conveyance charges incurred by children for going to school.

(d) Consumer services include medical care, litigation and domestic work, barbers, washermen, dry cleaners, carpenters, blacksmiths, priests, plumbers, gardeners, gold and silversmiths, and drivers.

(e) Education includes expenses on books, journals, newspapers, periodicals, stationery, school fees, private tutor's fees.

(f) House rent includes expenditure incurred on rented house. No imputation of rent for residential houses owned by the sample households was made.

(g) Miscellaneous includes biscuits and confectionery, intoxicants, pan, medicines, toiletry, sports and amusements, sundry goods (details unspecified in the study), ceremonials and gifts. This item is estimated as a residual.

Even in the sixth, seventh and eighth deciles these commodities are two-thirds as important as a proportion of incremental expenditure as the total of all nonagricultural commodities. Thus, the linkage effects of increased rural incomes are particularly strong with the nonfoodgrain parts of agriculture itself.

In India, milk and milk products are the most important of the nonfoodgrain agricultural commodities. They take roughly 12 percent of incremental expenditure in all but the highest and lowest income classes.6/ For the upper middle expenditure group (sixth, seventh and eighth deciles), milk and milk products are nearly twice as important as cotton textiles in absorbing incremental expenditure, a third more important than all textiles and over six times as important as consumer durables. Data for Bangladesh confirm the overall importance of livestock products in incremental consumption expenditures (11). However, milk is of less importance relative to other livestock products.

Given the dominant role of nonfoodgrain agricultural commodities in consumption, it is surprising that so little attention is given to them in development plans. Compared to food grains, supply of these commodities is much less dependent on a limited land base and so is potentially not as inelastic with respect to price. Many of these products are also highly labor intensive and needed capital goods may be produced locally and in a form that facilitates tapping previously unused savings potentials. Most important, the production opportunities are often broadly diffused geographically, facilitating a regional balance in labor use. There are, however, likely to be institutional restraints with respect to marketing, credit and other factors. Public policy must deal effectively with these restraints if the growth opportunities are to be realized.

Nonagricultural Commodities

Only 22 percent of incremental expenditure is allocated to nonagricultural commodities in the lowest two income deciles, while 49 percent is so allocated in an average of the sixth, seventh and eighth deciles (Table 3). Textiles comprise the largest single component of expenditure on nonagricultural commodities and remain relatively constant in proportion to incremental expenditure through the lowest eight deciles of expenditure. However, as expenditure increases the proportion of incremental expenditure to cotton textiles declines relative to woolens and synthetics.

6/ The expenditure elasticities decline with rising total expenditure--from 2.7 for the lower 3 deciles, to 2.0 for the sixth, seventh and eighth deciles, to 1.1 in the ninth and tenth deciles (6). But as total expenditure rises the base expenditure to which the elasticity is applied becomes larger, in this case, resulting in rather constant allocations of a given incremental expenditure. It is this latter concept which is most relevant in the dynamics of the linkages discussed here.

The proportion of expenditure to consumer durables and semidurables is low in all income classes, but does show a large percentage increase as total expenditure rises. Incremental expenditure on these items may be significantly understated because the period to which the data refer was one in which such items were not widely and readily available.

Incremental expenditure on consumer services and education rises sharply with increased income and attains major importance in the higher expenditure classes. These two categories of expenditure are comprised largely of labor of varying degrees of training.

The size of the miscellaneous category dramatizes the paucity of data with respect to expenditures on nonagricultural commodities. A fuller understanding of the growth linkages of increased foodgrains production must commence with more detailed knowledge of expenditure patterns of the various classes who may receive the increased income.

Rural-Urban Expenditure Differentials

The NCAER data, from which the demand functions are calculated, do not permit a division into urban and rural demand functions. The NSS data, which provide less detail in other respects, do allow an urban rural division. Expenditure elasticities for rural and urban areas separately are presented for three sets of commodities in Table 4. The expenditure elasticity for food grains is higher in all expenditure classes in the rural areas. Most notably, the elasticity drops much less with rising expenditure in the rural areas than in the urban areas. This has important implications to marketings, the generation of cash farm income and factor and product markets. However, the relatively high expenditure elasticities of demand for food grains in rural areas may well reflect past unavailability of manufactured goods in rural areas and therefore may drop rapidly with increased integration of rural areas into national markets. For example, detailed time series data from a village in Eastern U.P. suggest low demand elasticities for food grains of 0.1 to 0.2 among the upper income landowning classes (22).

Expenditure elasticities for milk and milk products are consistently somewhat higher in rural than urban areas. For clothing, they are lower in the low expenditure groups and then fall much less rapidly to end up higher in the upper expenditure groups.

Consumption functions certainly vary among socio-economic groups at any one point in time.[7/] They may also change over time, which is particularly likely in the dynamic context of rapid increase in income, enlargement and integration of markets and change in income distribution. Thus, in the

---

7/ See the sharp contrast in consumption patterns for high caste and low caste village Hindus within the same income classes as reported in (22), pp. 319-329.

TABLE 4. Comparison of Rural and Urban Expenditure Elasticities for Three Commodity Groups, by Expenditure Class, India, 1963-64.

Per capita monthly expenditure class	Rural			Urban		
	Food grains	Milk & milk products	Clothing	Food grains	Milk & milk products	Clothing
(Rupees)	(Elasticities)					
0-8	1.2	3.4	2.8	1.2	2.8	5.6
8-11	0.9	2.7	2.4	0.8	2.2	4.1
11-13	0.8	2.3	2.2	0.7	1.9	3.5
13-15	0.7	2.1	2.1	0.6	1.8	3.1
Lower Expenditure (bottom 3 deciles)	0.8	2.4	2.3	0.7	1.9	2.5
15-18	0.6	1.9	2.0	0.5	1.6	2.8
18-21	0.6	1.8	2.0	0.4	1.5	2.5
Lower Middle Expenditure (4th & 5th deciles)	0.6	1.8	2.0	0.4	1.6	2.6
21-24	0.5	1.7	1.9	0.3	1.4	2.2
24-28	0.5	1.6	1.9	0.3	1.3	2.0
Upper Middle Expenditure (6th, 7th and 8th deciles)	0.5	1.6	1.9	0.3	1.4	2.1
28-34	0.5	1.4	1.8	0.2	1.3	1.9
34-43	0.4	1.3	1.7	0.2	1.2	1.7
43-55	0.4	1.2	1.7	0.1	1.1	1.5
55-75	0.4	1.2	1.7	0.1	1.1	1.3
75 & above	0.3	1.0	1.6	0.1	1.0	1.1
High Expenditure (top 2 deciles)	0.4	1.3	1.7	0.1	1.1	1.4
Mean Elasticity	0.5	1.6	1.9	0.2	1.2	1.8

Source: Calculated from National Sample Survey No. 142, the Cabinet Secretariate, Government of India, by using a similar functional form as in Table 3, and to be reported in a forthcoming paper (27).

context of rapid technological change in agriculture, past consumer survey data can be no more than broadly indicative of changes in consumption.

Effect of Different Distributions of Income on Structure of Consumption Expenditure

The aggregate effects of alternative income distributions on expenditure patterns is summarized for two different examples in Table 5. The examples provide a rough approximation for the Indian economy of the effect of a four percent increase in foodgrains production. The first case exemplifies an increase in production achieved through new technologies which distribute benefits largely to the landowning classes. The second case exemplifies an increase achieved through traditional labor intensive techniques such as land reclamation, hand digging of wells and more careful crop husbandry.

An increase of four percent in foodgrain production generates about Rs. 3000 million of income (4 million tons at Rs. 750 per ton). We arbitrarily subtract 20 percent from gross value of output to cover costs of fertilizer, seeds, feed and other production costs. We assume that the remaining Rs. 2400 million is allocated to consumer expenditure and examine the pattern of that expenditure.[8/]

In one case, consistent with many of the new high-yielding foodgrain varieties, we assume 10 percent of the Rs. 2400 is expended by the laboring classes (the lower three deciles in expenditure patterns) and 90 percent is expended by the owner-cultivator class (the sixth, seventh and eighth deciles). As an alternative, we assume that 80 percent of the income is expended by the laboring classes and 20 percent by the owner-cultivator class. The latter is analagous to the probable division of expenditure in the case of traditional labor intensive increases in production.

In the first case, only about 13 percent of the added "expenditure" is allocated to food grains and hence is not sold out of the foodgrains sector. In the second case, 37 percent is consumed in the foodgrains sector. Presumably in both cases all the food grains produced will be consumed. The first involves much more complex production and trading relations.

The increment in demand for nonfoodgrain agricultural commodities has a somewhat different composition depending on the distribution of income. The increment in demand for milk and milk products is about 20 percent greater in the distribution that favors the upper income groups than that

---

8/ More realistically, we would assume quite different savings rates between the two classes and examine the capital expenditure patterns as well. We would also assume a different expenditure on production inputs. Available data did not permit this, and for simplicity of comparison we keep total consumer expenditure the same in the two cases.

TABLE 5. Distribution of Rupees 2400 Million Expenditure Assuming Two Different Distributions of Income.

Items	10% of expenditure by landless labor and 90% by owner-cultivator[a]			80% of expenditure by landless laborers and 20% by owner-cultivator[a]		
	Laborers expenditure (million rupees)	Cultivators expenditure (million rupees)	Total expenditure (million rupees)	Laborers expenditure (million rupees)	Cultivators expenditure (million rupees)	Total expenditure (million rupees)
1. Food grains	101	324	425	806	72	878
2. Milk & milk products	24	281	305	192	62	254
3. Meat, eggs & fish	8	65	72	58	14	72
4. Tobacco	2	43	45	19	10	29
5. Vanaspati	2	43	45	19	10	29
6. Other edible oils	12	64	77	96	14	110
7. Sweeteners	12	86	98	96	19	115
8. Other foods	12	194	206	96	43	139
9. Cotton textiles	22	151	173	173	34	206
10. Woolen textiles	-	22	22	-	5	5
11. Other textiles	-	22	22	-	5	5
12. Footwear	-	22	22	-	5	5
13. Conveyance	2	43	46	19	10	29
14. Consumer services	5	65	70	39	14	53
15. Education	2	65	67	19	14	34
16. Fuel & light	17	130	146	135	29	163
17. House rent	-	43	43	-	10	10
18. Durables & semi-durables	2	43	46	19	9	29
19. Miscellaneous	17	454	470	134	101	235
TOTAL	240	2160	2400	1920	480	2400

a/ Landless laborers defined as the lowest three expenditure deciles and owner-cultivator as the sixth, seventh and eighth expenditure deciles.

Source: Computed from data in Table 3.

which favors the lower income groups. The increment in demand for "other" foods, which includes fruits and vegetables, is 50 percent greater in the distribution toward the landowning classes than toward the laboring classes. In contrast, in the distribution toward the laboring classes, the demand is relatively larger for other edible oils and sweeteners.

Striking differences occur in demand for nonagricultural commodities. While the increment in demand for cotton textiles actually is 15 percent less in the distribution toward the rich as compared to the distribution toward the poor, the increment in demand for woolen and "other" textiles is more than four times larger in the "rich" case compared to the "poor." The increment in demand for miscellaneous goods, largely consumer non-durables is nearly twice as great in the "rich" case as compared to the "poor."

These are of course the consumption patterns that would occur if the underlying demand functions did not change and if adequate planning allowed the desired quantities to be produced and supplied without relative price changes. Increased knowledge of the effect of new production technologies on the size and distribution of income and expenditure can facilitate effective planning and resource use.

Manipulating Demand to Create More Employment

The preceding discussion emphasized the effects of market forces in transforming foodgrains production and income into demand and employment in other sectors.

The larger the share of increased foodgrains production received by the landowning classes the more likely that institutional rigidities, inappropriate factor proportions and export leakages will provide too low a level of employment to absorb the food grains produced or to provide an acceptably broad distribution of income. In that case, it may be desirable to manipulate the structure of demand through public policy. This may be done by taxes and subsidies on consumption goods which change relative prices, or by taxes on the higher income cultivator classes and expenditure by the government on high employment projects. An obvious possibility is rural taxation with the proceeds spent on rural public works. We describe this possibility to illustrate policy elements of such manipulation.

Rural public works may only be a device for transferring income. In that case, taxes are levied, works are developed with maximum labor content, and wage payments are made. The effect is as if the original increase in agricultural production had provided a lower level of labor efficiency and hence a higher factor share to labor.

If the purpose of rural public works is primarily transfer of income, the primary efficiency concern is that the bulk of the income be transferred to the laboring classes and not directly into the coffers of the

upper and middle class politicians and bureaucrats. The planning concern is with the balance between food and other goods required to back added income.

If public works can be productive of further increases in income, the objectives potentially become mixed. On the one hand, an objective may still be broader income distribution and greater employment which calls for maximizing wage payments. On the other hand, the objective may be increasing productivity, which may require a much greater proportion of expenditure on higher income engineers and administrators for developing engineering and administering the works and more expenditure on capital equipment to insure quality.

Mixing employment and production objectives for rural public works poses the problem of regional distribution of income. Rural public works will be most productive in the regions most affected by new foodgrains technology. The new technologies raise the returns to purchased inputs and greatly increase the quantity of output marketed. The effect is higher returns to a wide range of public works including roads, electrification, land leveling, education and markets. In addition, the progressive areas will experience growth in employment through the market forces delineated earlier in this section. Thus, the backward areas most need increased employment and yet may have neither the tax base nor the economic incentive for public works. It should be clear from discussion of the different expenditure patterns of various income classes that a program oriented toward backward regions in effect transfers laboring opportunities from the poor in one area to the poor in another. Public works are not a simple answer to this dilemma on either economic or political grounds.

IV. Comparative Capital-Labor Ratios in Consumption Goods Industries

Inelasticity of supply in the domestic consumer goods industries weakens the growth linkages arising from increased foodgrains production. Supply inelasticity in the important nonfoodgrains agricultural sector is likely to arise from institutional deficiencies rather than from large capital requirements.[9/] The remedy lies with recognition of the importance of that sector, diagnosis of the institutional needs and development of appropriate programs to meet those needs.

Production of industrial consumer goods may also be constrained by institutional barriers in input supply and markets. In addition high capital-labor ratios may provide a particularly important restraint.

9/ Production of many livestock products and fruits and vegetables in general are thought to be labor intensive. For example, in India, including labor for producing replacement animals, nearly half of the value of milk production is comprised of labor cost and most of the remainder is feed. The capital component is low (20, 25).

The higher the capital-labor ratio, the more likely that capital shortage will directly inhibit expansion.[10] Consequent relative price increases of consumer goods may then reduce production incentives for the foodgrains sector itself. Reinforcing this tendency, a low labor component in production will impede the distribution of income to the lower income laboring classes with consequent insufficient growth in foodgrains demand to maintain relative foodgrain prices in the face of increased foodgrains production. Thus in this context a high employment content of industrial expansion is not only desirable for improved equity but may be necessary to continued growth in foodgrains output.

Two reassuring points are apparent from comparative data on capital-labor ratios.[11] First, the capital-labor ratios are relatively low in the consumer goods industries experiencing the largest increase in demand from increased rural incomes (Table 6). Second, while there is considerable variation within these industries, important industries with high capital-labor ratios are primarily those catering to demand from urban consumers (Table 7). The capital-labor ratio for milk and milk processing is high and comparable to that of the chemical industry. The ratio for the cigarette industry is somewhat lower than for milk and milk products but much higher than that for several other major consumer goods industries and greatly higher than that for traditional forms of tobacco products. Under small town and rural conditions these products or their close substitutes are consumed in a form requiring much less capital intensity in their production.[12] Thus, the structure of demand may influence the choice

---

10/ We emphasize the direct capital-labor ratios in the industries experiencing increased demand. Components for these industries which are produced with high capital-labor ratio processes may be imported. It is thus likely that the linkages we describe will require increased trade. The complexity of increased trade will be less and success more likely if the capital-labor ratios are low in the commodities experiencing a direct increase in demand. Hence our emphasis on the direct capital-labor ratios (17).

11/ The data with respect to capital-labor ratios in consumer goods industries are meager and difficult to interpret. First, the demand for, and hence, the commercial production of many potentially important consumption goods has been negligible in the past. As a result, the data collection relating to these production processes has suffered in quantity and quality. Second, much of consumer goods production, such as processing of meat, poultry, eggs, milk, fruits and vegetables has been undertaken on a small scale, often as only subsidiary to the cultivation of crops. Consequently, the quality of the existing data is often extremely poor. Third, in collecting data, the highly organized large scale surveys have often shown a bias in favor of the most capital intensive processes. This is partly because they lie in the organized sector, which makes the data much less elusive (10).

12/ For an example of potential for reducing capital intensity through small-scale operations in providing milk marketing and processing services, see (25).

TABLE 6. Capital-Labor Ratios and Value Added, by Industrial Sector, 1960-1964.

Industry	Productive capital per employee (Rupees)	Plant mach. & tools per employee (Rupees)	Percent of total value added 1960	Percent of total value added 1964
1. Food Mfg. Industries, Except Beverage Industries	8,077	3,029	12.0	8.1
2. Beverage Industries	15,578	5,487	0.3	0.4
3. Tobacco Mfrs.	3,856	399	2.0	1.3
4. Textile Mfrs.	4,877	2,219	31.8	26.0
5. Mfr. of Footwear, Other Wearing Apparel & Made-up Textile Goods	4,182	774	0.1	0.2
6. Mfr. of Wood & Cork; Mfr. of Furniture & Fixtures	6,095	1,648	0.8	0.7
7. Mfr. of Paper & Paper Products; Printing, Publishing & Allied Industries	11,308	6,181	4.4	4.1
8. Mfr. of Leather & Fur Products Except Footwear & other Wearing Apparel	6,011	947	0.3	0.2
9. Mfr. of Rubber Products	13,076	4,643	2.6	1.9
10. Mfr. of Chemicals & Chemical Products	26,436	11,123	8.3	8.4
11. Mfr. of Products of Petroleum & Coal	126,056	57,793	1.8	1.3
12. Mfr. of Nonmetallic Mineral Products except Products of Petroleum & Coal	9,054	4,053	4.4	3.7
13. Basic Metal Industries	35,035	22,109	8.7	12.8
14. Mfr. of Metal Products except Machinery & Transport Equipment	9,185	3,048	2.1	2.3
15. Mfr. of Machinery except Electrical Machinery	11,453	4,685	3.2	5.3
16. Mfr. of Elec. Mach., Apparatus, Appliances & Supplies	13,921	4,399	3.3	4.2
17. Mfr. of Transport Equipment	8,551	2,949	10.2	9.7
18. Miscellaneous Mfg. Industries	6,823	2,599	1.1	1.2
19. Electricity, Gas & Steam	52,171	38,882	2.6	8.2
TOTAL			100.0	100.0

Source: Government of India, Annual Survey of Industries, Vol. 1, 1964.

TABLE 7. Capital-Labor Ratios and Value Added for Various Consumer Goods Industries, India, 1960-1964.

	Productive capital per employee	Plant mach. & tools per employee	% of all industrial value added	
			1960	1964
Milk Foods & Malt Foods	26,446	12,949	0.1	0.1
Other Foods				
Processed Fish & Seafood	6,498	4,249	-	-
Processed Fruits & Vegetables	5,871	1,678	-	0.1
Tobacco				
Biri	816	33	0.2	0.0
Cigarette	17,798	2,056	1.2	1.2
Snuff	10,754	1,267	-	-
Jerda	3,658	476	0.1	-
Other Tobacco	1,653	135	(not comparable)	
Edible Oils	7,635	2,380	0.6	0.4
Other Oils				
Vanaspati	14,010	4,299	0.9	0.4
Sweeteners				
Sugar	12,107	6,113	4.4	3.0
Gur	1,961	976	-	-
Cotton Textiles	4,843	2,382	23.7	17.7
Other Textiles				
Wool	9,259	2,729	0.7	0.8
Art Silk	11,427	5,274	1.3	2.2
Footwear	4,821	610	-	0.1

Source: Government of India, Annual Survey of Industries, Vol. 1, 1964.

techniques as well as influencing the scale of production of many of these consumer goods. Through both of these factors, the structure of demand associated with rising rural incomes may encourage a more decentralized and labor-using pattern of industrialization. That pattern may however require considerable facilitative action with respect to the rural infrastructure.

Tables 6 and 7 also present data for proportion of value added in manufacturing contributed by each of the industry categories in 1960 and 1964. In this period the industries which would experience sharp increase in demand from increased rural incomes, actually experienced a relative decline.[13/] Particularly large relative declines occurred in the low capital-labor ratio agricultural processing and textile industries. As a consequence average capital-labor ratios increased markedly and the employment content of growth decreased. Major increases in rural incomes through increased output of new foodgrain varieties may reverse this tendency and change the structure of demand and output growth toward more labor intensive industries.[14/] Thus even without tapping new sources of savings, capital may be less of a constraint to output and employment growth when responding to linkages with the foodgrain sector as compared to the processes of the past.

V. Linkages Between Foodgrains Production and Employment with Emphasis on Nonfoodgrains Agriculture

From the analysis of incremental consumption expenditure we saw that nonfoodgrain agricultural commodities are one of the most important

---

13/ For India, the effect of change in industrial structure alone was sufficient to increase the average capital-labor ratio by 20 percent from 1957 to 1964, and by an additional 22 percent from 1960 to 1964. The change in average capital-labor ratio was calculated by assuming the capital-labor ratio for each industry constant at its 1964 level and then weighting that ratio by the proportion of value added contributed by each industry for each of the years measured. Thus change in the ratio by this calculation is entirely due to change in the proportion of value added by each industry. The data are from the Annual Survey of Industry (12). For details, see a forthcoming paper in the Cornell University-USAID Income Distribution Project Occasional Paper series.

14/ Accelerated growth in the consumer goods industries does not necessarily require slower growth in the more capital intensive capital goods industries. In the context discussed here, growth in the capital goods industries is a complex function of what happens to trade relations, domestic savings rates and foreign capital flows. These forces could result in faster growth in those capital intensive industries even while the less capital intensive industries further accelerate growth. We emphasize the role of growth in the less capital intensive consumer goods industries whether or not other forces favor the more capital intensive industries.

consumption goods categories. These commodities also tend to be highly labor intensive in their production. Thus expanded demand for these commodities offers major opportunity for an equilibrium with increased foodgrains production, at high levels of employment and small reduction in relative prices of food grains. In this section we present the results of a simulation model designed to measure the potential for employment increases in the nonfoodgrains agriculture sector in response to increased demand derived from increased foodgrains production. The exercise is limited, meant to be broadly indicative of potentials.[15/]

We assume a rate of growth of foodgrains production of 3.9 percent per year, achieved largely through technological change in foodgrains production which distributes the bulk of the increased income to the landowning classes. The latter are defined as falling in the sixth through eighth deciles in the rural income distribution.[16/] We then calculate how much the employment of the laboring classes would have to increase to generate an increment in demand for food grains sufficient to absorb all the increased foodgrains production with no change in relative prices. The laboring class is defined by the lowest three deciles in the rural income distribution, and assume population growth of 2.5 percent per year. For this analysis we use the demand functions and data stated in Table 3. We assume wage rates remain constant, so laborer's income grows with employment. We calculate the increase in demand for nonfoodgrain agricultural commodities. With assumed constant output-labor ratios in production in that sector, we calculate the increase in labor requirements in production of nonfoodgrain agricultural commodities.

We know the increase in employment in foodgrains production from the initial assumptions and calculate the total increase in employment, and

---

15/ The details of this simulation model will be reported in a forthcoming paper in the Cornell University-USAID Income Distribution Project Occasional Paper series.

16/ Our assumption about the distribution bias is complex, but arrives at the above result. We assume that initially only 10 percent of the acreage is in a high yielding sector. Fifty percent of the land in this high yielding sector is double-cropped. Output per cropped acre in the high yield sector is 1.95 times as high as in the traditional sector, which has much lower yields and a single crop. Ten percent of the incremental share in the high yield sector goes to labor. Foodgrains output in the traditional sector grows at the rate of 2.5 percent per year. Eighty percent of the incremental share in this sector goes to labor. One percent of the initial cropped area is transferred from the traditional to the modern sector per year. The production increases 1.95 times on this transferred acreage. This is a major source of increase in output and, as stated, only 10 percent of the incremental share goes to labor. Yields per acre in the modern sector continue to increase at a constant rate of 3 percent per year.

the increase in employment in nonfoodgrains agriculture. The residual between the total and these two components is assumed to be absorbed in the nonagricultural sector.[17]

Given these assumptions, a 5.3 percent rate of growth of total employment is needed to maintain constant relative foodgrains prices. The required growth rate for employment increases to 6.2 percent in 20 years. The assumptions lead to a rate of growth of employment of 4.6 percent in the foodgrains sector. This gradually declines to 3.6 percent.[18] Initially 36 percent of the increase in employment occurs in the foodgrains sector.

The rate of growth of employment in the nonfoodgrain agricultural sector is initially 5.7 percent per year and increases to about 6.5 percent, with over 20 percent of the total employment growth occurring in this sector.

Employment in the nonagricultural sector, estimated as a residual, grows initially at a rate of 3 percent per year and increases to 4 percent in 20 years. These are low growth rates of employment by the standards of achievement in the Indian Third Plan period. It seems likely that both demand and capital availability would allow a factor rate of growth of nonagricultural production. Thus the wages-goods restraint shown here is probably the effective restraint. The restraint is tight for this sector because it is defined as the residual sector and the growth rate of employment in the two agricultural sectors is rapid.

The foodgrains production increase stated in this example, is achieved in significant part from the traditional sector with a high labor share. We test the sensitivity of our calculations to change in this assumption by reducing the rate of growth of output in the traditional sector in half, from 2.5 percent to 1.25 percent per year. With all other assumptions the same, that reduces the overall growth rate of foodgrains production to 2.9 percent per year, that rate increases gradually with the shift of acreage to the modern sector.

17/ In order to focus on the effect of demand factors, we, at this stage, disregard questions of supply of capital and change in technology in these sectors.

18/ The high growth rate in foodgrains employment is partly statistical resulting from an assumption of substantial disguised unemployment in the agricultural sector. An assumption of a lower level of disguised unemployment (and hence a higher level of employment) would reduce the rate of growth of employment. In addition, it will be noted that a significant proportion of the increase in foodgrains production is assumed to occur in the traditional sector with increased use of labor. This assumption may be a precondition if the overall rate of growth of foodgrains production is to be as high as 3.9 percent. This is because the growth in irrigation and the research on high yielding varieties may not expand rapidly enough to allow a faster rate of transformation of the traditional to the modern sector than is assumed.

With the slower growth rate for foodgrains production, per capita income of the laboring class grows much more slowly, initially at 0.7 percent and up to only 2 percent per year after 20 years. This compares with the initial 2.8 percent rate, increasing to a 3.7 percent rate of increase when foodgrains growth rate was 3.9 percent. The welfare importance of high growth rates in foodgrains production is clear in this context. With a slow rate of growth of foodgrains production, total employment growth is 3.2 percent per year, and gradually rises to 4.5 percent after 20 years. Employment in the nonfoodgrains agricultural sector grows at a rate that is less than 60 percent of the rate obtained with the higher growth rate of foodgrains production.

As a further test, we changed the initial assumptions to achieve the same initial growth rate for foodgrains production as in the previous case, 2.9 percent, but achieved a faster growth rate in the traditional sector (2.5 percent) and a slower transfer of acreage from traditional to modern.

Two effects are noteworthy. First, in the initial years the distribution of foodgrains output is much more toward labor, and second, the rate of growth of output hardly accelerates because of the small proportion in the modern sector. Initially, total employment and hence income growth of the laboring class is comparable in the two cases. However, in the more traditional oriented growth, the composition of employment growth is much more in the foodgrains sector. Thus employment in foodgrains production grows initially at 4.5 percent compared to 2.4 percent for a more modern pattern of growth. The nonagricultural labor force grows much more slowly at 1.4 percent in the traditional oriented case compared to 3.0 percent in the more modern oriented case. Naturally, in the early years when per capita income growth is similar, growth rates in the nonfoodgrain agriculture sector is similar.

VI. Conclusion

Increased foodgrains production has the potential for large growth inducing linkages with other sectors of the economy. These linkages arise primarily because of the increase in demand for goods and services produced in other sectors of the economy and the increased potential to support a larger labor force in those other sectors. It is increased marketings of food grains and consequent increased cash farm incomes which provides the first element of these linkages. The size of the linkage depends on the initial distribution of income from the foodgrain production technology.

Because of the nature of the foodgrain production linkages, sound planning requires knowledge of the distribution of benefits from foodgrains technology, the consumption patterns accompanying increased incomes of various socio-economic groups, the capital-labor ratios in the industries experiencing increased demand and the nature of other inhibitions to expansion of these industries. Our exploration of these factors suggest strong employment linkages with increased foodgrains production. If the employment linkages are weak, demand for foodgrains may not be sufficient

to sustain levels of foodgrains prices profitable to maintaining growth in foodgrains production. In that case production considerations will demand search for means of increasing the employment linkages through manipulation of consumption patterns and other devices. Thus in the case of stimulus to growth arising from increased foodgrain production long run equity and production considerations may be highly complementary.

References

1. Acharya, S. S., "Comparative Efficiency of High Yielding Varieties Programme--Case Study of Udaipur District," Economic and Political Weekly, Vol. IV, No. 44, Nov. 1, 1969.

2. Agro-Economic Research Centre, Report on the Study of High Yielding Varieties Programme, Kharif and Rabi 1968-69, Phase II, Andhra University, Waltair.

3. Billings, Martin M. and Arjan Singh, "Labor and the Green Revolution - The Experience in Punjab," Economic and Political Weekly, Vol. IV, No. 52, Dec. 27, 1969.

4. Crisostomo, C. M., W. H. Meyers, T. B. Paris, Jr., B. Duff, and R. Barker, "The New Rice Technology and Labor Absorption in Philippine Agriculture," a paper presented at the Conference on Manpower Problems in East and Southeast Asia, Singapore, May 1971.

5. Desai, B. M. and M. D. Desai, New Strategy of Agricultural Development in Operation, Agro-Economic Research Centre, Sardar Patel University, Vallabh Vidyanagar, 1968.

6. Desai, B. M., "Analysis of Consumption Expenditure Patterns in India," Forthcoming Occasional Paper No. 54, Department of Agricultural Economics, Cornell University - USAID Employment and Income Distribution Project.

7. Dixit, R. S. and P. P. Singh, "Impact of High Yielding Varieties on Human Labor Inputs," Agricultural Situation in India, Vol. XXIV, No. 12, Mar. 1970.

8. Higgins, Benjamin, Economic Development - Principles, Problems, and Policies, New York: W. W. Norton & Company, Inc. 1959.

9. Hirschman, A. O., The Strategy of Economic Development, New Haven, Conn.: Yale University Press, 1958.

10. Horowitz, Grace, "Capital-Labor Ratios, Capital-Output Ratios, and Rates of Profit in Indian Industry," Occasional Paper No. 44, Department of Agricultural Economics, Cornell University-USAID Employment and Income Distribution Project, Feb., 1971.

11. Islam, Nurul, Studies in Consumer Demand, Vol. 1 and 2. Oxford University Press, 1965 and 1966.

12. India, Government of, Cabinet Secretariat, Department of Statistics, Annual Survey of Industries, Vol. 1, Calcutta, India, 1964.

13. _____, Cabinet Secretariat, National Sample Survey, Nos. 142 and 162.

14. India, Government of, Programme Evaluation Organization, Planning Commission, "Evaluation Study of the High Yielding Varieties Programme," Kharif and Rabi, 1968-69.

15. _____, Programme Evaluation Organization, Planning Commission, "Evaluation Study of the High Yielding Varieties Programme," Rabi 1967-68 - Wheat.

16. Lele, Uma J., "The Green Revolution: Income Distribution and Nutrition," Occasional Paper No. 48, Department of Agricultural Economics, Cornell University-USAID Employment and Income Distribution Project, Sept., 1971.

17. Lele, Uma J., and John W. Mellor, "Jobs, Poverty and the Green Revolution," International Affairs, Jan., 1972.

18. Masud, Sharif Md. and F. L. Underwood, "Gumai Bil Boro Paddy Profits and Losses, 1967-68 Season," F. M. Research Report No. 5, Bureau of Agricultural Economics, Statistical and Sociological Research, East Pakistan Agricultural University, Mymensingh, April, 1970.

19. Mellor, John W., "The Functions of Agricultural Prices in Economic Development," The Indian Journal of Agricultural Economics, Vol. XXIII, No. 1, Jan.-Mar., 1968.

20. _____ and Bruno de Ponteves, Estimates and Projections of Milk Production and Use of Concentrate Feeds, India, 1951-1976, Cornell International Agricultural Development Bulletin No. 6, Cornell University, Ithaca, N. Y., Dec., 1964.

21. _____ and Uma J. Lele, "A Labor Supply Theory of Economic Development," Occasional Paper No. 43, Department of Agricultural Economics, Cornell University-USAID Employment and Income Distribution Project, June, 1971.

22. _____, Thomas F. Weaver, Uma J. Lele and Sheldon R. Simon, Development Rural India, Ithaca, N. Y.: Cornell University Press, 1968.

23. Mishra, J. P. and B. D. Shukla, "A Study on the Economics of High Yielding Varieties Programme," Agricultural Situation in India, Vol. XXIV, No. 2, May, 1969.

24. National Council of Applied Economic Research, "All-India Consumer Expenditure Survey," Vol. II, 1967.

25. Nightingale, Ray W., The Modernization Decision in Indian Urban Fluid-Milk Markets, Cornell International Agricultural Development Bulletin No. 15, Cornell University, Ithaca, N. Y., Aug., 1969.

26. Selley, R. and B. M. Desai, "Consumption Expenditure Patterns in India -- Some Methodological Consideration," Forthcoming Occasional Paper No. 55, Department of Agricultural Economics, Cornell University-USAID Employment and Income Distribution Project.

27. Tripathy, R. N. and B. Samal, "Economics of High Yielding Varieties in IADP: A Study of Sambalpur in Orissa," Economic and Political Weekly, Vol. IV, No. 43, Oct. 25, 1969.