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LONG RUN POSSIBILITIES FOR INCREASING INCOMES AND EMPLOYMENT IN THE FARM SECTOR OF DEVELOPING COUNTRIES: INDIA*

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The farm sector will continue to be important as a source of income and employment for most persons in the developing countries of Asia. As an employer, the urban sector is small relative to agriculture. Consequently, most increases in income and employment opportunities will have to be provided within the farm sector. Yet, relative to the rate of increase in the size of the farm labour force, one wonders whether the farm sector will be able to provide a "satisfactory" rate of increase in income and employment opportunities.

Concern over income and employment in the farm sector is reflected in two dimensions. The first aspect is concerned with the equity with which income and employment opportunities are distributed.

The second focuses on whether the farm sector can grow rapidly enough, relative to the rate of increase in the labour force, to provide increases in per capita incomes—even if incomes and employment are widely distributed.

In the first place the rate of increase in demand for farm products may be too small to support a "large" rate of increase in income and employment opportunities in the farm sector. Also, rapid increases in the use of purchased as compared with farm produced inputs in farm production may direct more of the income derived from farm production to owners of land and capital rather than to farm labourers.

Because many of these inputs are new and the experience of other developed countries offers only limited insights, the prospects for increasing income and employment opportunities in agriculture are not clear. Some of the uncertainty stems from the nature of the purchased inputs. Some—the improved seeds and fertilizer, for example—are land saving and labour using. Others, such as various farm implements, are *prima facie* labour saving.

Nevertheless, there are forces which operate within any economy which cause the rate of change in income paid to labour, or any other factor of production, to change in a predictable manner. Many of these forces can be examined within the framework of the theory of aggregate income distribution.

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Using this framework, this paper estimates the probable total and per capita annual rate of change in income and employment for farm labour in India over, say, the next ten years. The estimates themselves are of interest because they indicate the rate of increase in farm income and employment which may be expected. The framework used to derive these estimates is also of interest. The estimating framework, while not fully developed, focuses attention on the major determinants of income and employment generation in agriculture and their relationship to each other. With such information, guidelines can be developed which suggest economy-wide and sector specific policies which may enhance the rate of growth and distribution of employment and income opportunities in developing countries. The analysis in this paper is specific to India, but the underlying rationale has general application.

In the first section the general predictive framework is developed, and the individual components of it are described. Also, estimates of the numerical coefficients of the components of the predictive framework are developed. In the second section, this framework is used to derive estimates of the probable total and per capita rate of annual increase in income and employment in agriculture. Subsequently, the implications of these estimates are discussed with respect to development policy.

FACTORS INFLUENCING THE GROWTH OF AGGREGATE FARM LABOUR INCOME AND EMPLOYMENT

The rate of increase in income to farm labour depends on: (1) the rate of increase in income to all factors of farm production and (2) changes in the income share which remits to farm labour.

This follows directly if one assumes that all income from an industry is allocated among the contributing factors of production. That is, if production inputs—land, labour, and capital—are paid according to their marginal contribution to total agricultural revenue, then the total value of farm production equals the value of (income paid to) inputs used in production (equation 1).[1]

1. This treatment varies somewhat from, but is in the same spirit as that by Weintraub. [15]* Weintraub [15, p. 27] conceives of the total proceeds of an economy as being allocated among labour (a wage share), rents (payments to fixed factors), and profits (a residual share for entrepreneurship). The income claimants considered in this paper (land, labour, capital) receive income for services performed as in the Weintraub scheme.

This approach also varies from other analyses which have examined changes in the income share of factors of production as a means of explaining changes in aggregate farm production. [6, 15] These as well as other studies have, in varying degrees, been unable to explain all of the changes in farm production in terms of changes in employment of the respective farm production inputs. The unexplained portion has been attributed to technological change. While technological change is a non-price supply shifter, it is not an income claimant. The returns from technological change which remit back to the farm sector are paid to the respective income claimants.

* Figures in brackets in the text and footnotes refer to the literature cited at the end of the paper.

(1) $Y = A + L + K$ where,

Y is total agricultural revenue and A, L, and K are the total income paid to land, labour, and capital, respectively. The annual rate of change in income to all production inputs depends on the rate of change in total agricultural revenue. In turn, the annual rate of change in total agricultural revenue is jointly determined by the annual change in the supply of and demand for farm products.

This paper, however, focuses on changes in income to farm labour. The income share paid to farm labour is :

$$(2) \quad {}^{s}_{L} = \frac{L}{Y} = \frac{b\ w}{Y} \text{ where,}$$

w is the wage-paid farm labour (say in rupees per day), q is the quantity of labour employed (in man-days), and $L = w.q$. The total income imputed to farm labour (w.q.) then is the product of (Y) the total income to all factors of production and (${}^{s}_{L}$) labour's income share (equation 3).

$$(3) \quad L = w.q = {}^{s}_{L}.Y$$

Annual changes in the income paid to farm labour can be examined by analysing changes in (3) with respect to time.

The annual rate of change in income to farm labour (L) is found by finding the total time derivative of (3) and then dividing by L.

$$(4) \quad dL = {}^{s}_{L}dY + Yd{}^{s}_{L}$$

$$(5) \quad \frac{dL}{L} = \frac{1}{L} \left({}^{s}_{L}dY + Yd{}^{s}_{L} \right)$$

The rate of change in income to farm labour simplifies to :

$$(6) \quad \frac{dL}{L} = \frac{dY}{Y} + \frac{d{}^{s}_{L}}{{}^{s}_{L}}^{2}$$

Equation 6 is the general basis of the estimating model. It shows that the rate of change in income to farm labour depends on the rate of change in (1) total agricultural revenue and (2) the share of total agricultural revenue paid to farm labour. Conceptually, the former is important because it indicates the rate of change in income to all factors of production.

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2. This simplification is possible because, by definition, $\frac{1}{L} = \frac{1}{s_L . Y}$.

The components of this model follow by definition from the assumptions outlined at the beginning of this section. However, while useful for prediction, this equation tells nothing of the *behavioural* relations which influence the size of $\frac{dY}{Y}$ and $\frac{d^{S}_{L}}{s_{L}}$. These are considered in the following sections while developing the numerical coefficients (for $\frac{dY}{Y}$ and $\frac{d^{S}_{L}}{s_{L}}$) to be used in the employment estimations.

Changes in Income to All Factors of Production

Of the two factors influencing the rate of growth in income to farm labour, limitations on the rate of growth in income to all factors of production $\left(\frac{dY}{Y}\right)$ seems to be most important. Changes in $\frac{dY}{Y}$ jointly depend on the rate of growth in aggregate supply of and the demand for farm products. Historically, slow rates of growth in total farm income have been associated with slow rates of growth in the supply of farm products. Over the long run, however, restrictions on the rate of growth in aggregate demand for farm products will be the major factor restraining the total and per capita rate of growth in income and employment to farm labour. The demand for production inputs in any industry is derived from and depends on the demand for the final product(s) of that industry. Consequently, the rate of increase in demand for the products produced by labour strongly influences the rate of change in income paid to farm labour—a major input in farm production. [15, p. 33][3]

The rate of growth in aggregate demand for farm products is a major determinant of income growth in the agricultural sector because, for most farm products, the price elasticity of demand is less than one.[4] An increase in supply relative to demand causes product price to decline by proportionately greater amount than the increase in production. Consequently, an increase in production, demand assumed *ceteris paribus*, may cause total agricultural revenue to decrease rather than increase. In actual practice, both aggregate demand and supply increase over time, though not necessarily at the same rate. Consequently, the proportional change in product price depends on the change in aggregate supply *relative* to the change in aggregate demand. Nevertheless, any increase in farm production which exceeds the rate of increase in aggregate demand will cause total agricultural revenue to increase by an amount which is proportionately smaller than the increase in

3. For an empirical analysis of this relationship as applied to employment of farm labour in the United States see Gisser. [2] and [3, p. 590]

4. The price elasticity of demand for rice, wheat, and a weighted average of all major cereals have been estimated for India as —0.19, —0.73 and —0.46, respectively. [12, p. 80]

physical production.[5] Only an extreme increase in production relative to demand, however, will cause total agricultural revenue to remain unchanged or to decline with an increase in farm production. Nevertheless, the rate of increase in income to all factors of farm production is circumscribed by a price inelastic demand for farm products.

To get some notion of the probable rate of increase in income to all agricultural inputs it is useful to examine the probable rate of increase in aggregate demand for farm products. For this analysis, aggregate supply of farm products is assumed to increase at the same rate as aggregate demand.[6] This assumption precludes the need to consider the effects on total agricultural revenue arising from changes in the terms of trade between the farm and non-farm sector arising due to changes in farm product prices. The assumption also implies that increases in farm production will occur primarily as a result of non-product price supply shifters—improvements in production technology and increased supplies of purchased inputs. By implication, this assumes that non-product price supply shifters are being injected into Indian agriculture at a rate which causes farms to increase production at a rate which is approximately equal to the increase in aggregate demand. Most importantly, from among the range of assumptions regarding relative changes in the supply of and demand for farm products, this assumption generates the most optimistic projected rate of increase in real income to all factors of farm production for any given set of demand conditions.

The rate of increase in aggregate demand for farm products depends on the : (1) initial domestic supply of farm products relative to demand, (2) rate of increase in domestic demand for farm products, and (3) the rate of increase of exports of farm products.

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5. Suppose the quantity of farm production (q) equals an index of 100, production increases by five index units (dqs), demand increases by 3.5 index units (dqd), the price elasticity of demand ηpy is —0.50, and the initial index of farm prices (P) is 1. The new total revenue (TR*) which occurs with a simultaneous change in quantity produced and product price is: $TR^* = (q + dq) \cdot (p + dp)$. With q, dq, and p given as data, only dp need be calculated to solve for TR*. The change in price (dp) is calculated from ηpy which is $-0.5 = \frac{dq}{dp} \cdot \frac{p}{q}$. In solving for dp, however, the appropriate dq is 1.5 units (dqs—dqd). "dp" is —0.03. Solving for TR* :$TR^* = (100 + 5)(1 - 0.3) = 1.85$. Total revenue increased by 1.85 per cent, even though physical production increased by 5.0 per cent.

6. This analysis emphasizes the opposite side of the supply-demand problem which India faced from Independence through, say, 1965. During these years, the major concern was to induce farmers to increase production as rapidly as the rate of increase in aggregate demand. Agricultural supply deficits have not been completely eliminated. Nevertheless, increases in wheat, rice, and bajra production indicate that a critical mass of supply shifters [9, p. 516] is or has been assembled and suggest that aggregate farm production can increase more rapidly than aggregate demand.

The validity of the assumption is an empirical question, and can be evaluated only after the fact. On *a priori* grounds, however, the assumption implies that increases in farm production will occur primarily as a result of supply shifters (improved technical production possibilities and increased supplies of farm inputs, for example). Further, an increase in production which exceeds the increase in demand implies that the supply shifters are sufficiently strong to compensate for negative production stimuli afforded by a decline in product prices. The validity of the assumption, therefore, depends on the validity of the assertion (hypothesis) that non-price production stimuli are being injected into Indian agriculture at a rate which causes farms to increase production at a rate which is approximately equivalent to the increase in aggregate demand.

The initial domestic supply of farm products relative to demand has importance in India because relative supply deficits have been offset by imports of farm products (particularly foodgrains) on concessional terms. In India, in the mid-1960's aggregate demand for food products substantially exceeded supply. Even in 1970-71 the supply of foodgrains (about 104 million metric tons) was 5.4 per cent less than the estimated demand for foodgrains (about 112 million metric tons). [12, p. 9] In this and other similar situations domestic production of farm products can, over the short run, increase more rapidly than the annual increase in demand for farm products without causing a decrease in farm product prices. This is possible because a portion of the net increase in supply relative to demand can be used to substitute for imported farm products.

The rate of increase in domestic demand for farm products depends on: (1) the rate of increase in population, (2) proportional increases in per capita income, and (3) the income elasticity of demand for farm products. This can be reflected as:

$$(7) \quad D = p + \eta_{yi} \quad g \text{ where,}$$

D is the annual rate of increase in domestic demand for farm products, p is the rate of population growth, η_{yi} is the income elasticity of demand, and g is the rate of increase in per capita income.[7] For India, assume that p=2.3 per cent [1, p. 1], η_{yi}=0.75, and g=1.6. [1, p. 8] Inserting these coefficients into (7), the annual increase in demand for farm products (d) is approximately 3.5 per cent.[8] Once the initial deficit in domestic farm production is overcome, this is the approximate rate of increase in farm production which the domestic economy can absorb without causing a decline in farm product prices.

A net increase in exports of farm products can augment the growth in aggregate demand for farm products. India's *Fourth Five-Year Plan* emphasizes the need to increase exports of farm products—marine products, leather, and leather products, fresh fruit, and vegetable oils. The Plan projects an annual increase in exports of farm products of 6.5 per cent from 1968-69 to 1980-81. [4, p. 43] Farm exports, however, comprise only about 5.7 per cent of the total value of farm production. Hence, the export promotion targets for agriculture, while admirable and probably feasible, will cause only a 0.36

7. This computational formula abstracts from several complicating features which influence the rate of increase in demand for farm products. The estimated value of η_{yi}=0.75 used in the text incorporates many of the facets. It is weighted by variations in (1) commodity bundles by income groups and economic sector and (2) income elasticities of demand by commodity and sector (Appendix Table A.1). Weighted average income elasticities of demand for farm products are 0.728 and 0.696 for the rural and urban sector, respectively. With 80 per cent of the population residing in the rural sector and 20 per cent in the urban sector an aggregated weighted income elasticity of demand for farm products is 0.722.

8. This is based on an assumption that the proportional increase in income is equally distributed among all income groups.

per cent annual increase in aggregate demand for farm products.[9] This can of course be reduced (increased) by any increase (decrease) in imports of farm products.

Combining the rate of growth in domestic demand for farm products (3.5 per cent) with that from the export sector (0.4 per cent), aggregate demand for farm products is seen to grow by about 3.9 per cent annually. Likewise, a realistic yet optimistic annual rate of increase in real income to all factors of production in agriculture is 3.9 per cent. The projection model therefore uses 3.25, 3.75, and 4.25 as a range of empirical coefficients for $\frac{dY}{Y}$. The following section evaluates the effect of various rates and directions of change in the income share paid to farm labour on total and per capita rates of change in income and employment to farm labour.

Changes in Labour's Income Share

The rate of increase in labour income and, to some extent, employment of farm labour will be greater than, equal to, or less than the rate of increase in income to all factors of farm production depending on whether the income share paid to farm labour increases, remains constant, or decreases. This follows by definition from equation 6.

$$(8)\quad \hat{L} = \hat{w} + \hat{q} > \hat{Y} \text{ if } \hat{s}_L > 0$$

$$\hat{L} = \hat{w} + \hat{q} = \hat{Y} \text{ if } \hat{s}_L = 0$$

$$\hat{L} = \hat{w} + \hat{q} < \hat{Y} \text{ if } \hat{s}_L < 0 \text{ where,}$$

$\hat{L}$, $\hat{w}$, $\hat{q}$, $\hat{Y}$ and $\hat{s}_L$ are $\frac{dL}{L}$, $\frac{dw}{w}$, $\frac{dq}{q}$, $\frac{dY}{Y}$, and $\frac{ds_L}{s_L}$, respectively.

If $\hat{s}_L < 0$ total income to farm labour will increase less rapidly than the rate of increase in total income to all factors of farm production.

Also, regardless of the rate of increase in income to farm labour, there is a direct trade off between employment generation and increases in farm wages. Most analyses of the rural low income problem emphasize the shortages of farm employment opportunities relative to the number of persons seeking employment. An important means of increasing income to farm labour, therefore, is to increase the amount of employment opportunities in agriculture. If increasing employment is a valid proxy for increasing in-

9. The annual percentage increase in aggregate demand for farm products due to a net increase in exports is the product of the annual percentage net increase in farm exports and the per cent of exports in the total value of farm production (5.7 per cent × 6.5 per cent = 0.36 per cent).

comes of farm labour, increases in farm wages will be counter-productive to that goal. Where surplus labour exists, and increased quantities of labour can be obtained at current wages, market forces will stimulate increased employment with little or no increase in wages. Further, as shown in (8), increases in wages may reduce the rate of increase in farm employment.

While not explicitly incorporated in the above framework, increases in farm wages may reduce the rate of growth in employment, by encouraging farm operators to substitute capital for labour. The degree of substitution of capital for labour also depends on changes in the supply and technical efficiency of capital. Nevertheless, to the extent that farm wages increase, particularly relative to the price of capital, capital substitution for labour is encouraged. In turn, this will slow the rate of growth in labour's income share ($\hat{s}_L$) and will reduce the rate of growth in income to farm labour.[10]

Estimates of Probable Changes in Labour's Income Share : To predict the rate of change in total and per capita income and employment for farm labour, the estimates of the direction and rate of change in labour's share of total agricultural revenue are derived for the period 1910-1965. The estimates are derived from studies in three countries—Japan, Taiwan, and the United States. The estimates vary somewhat due to differences in economic conditions in the respective countries, data sources, and measurement procedures used in each study. In the United States between 1910 and 1965, s_L declined markedly. In Japan and Taiwan s_L remained about constant (Table A.2).

Ruttan and Stout [13] and Lianos [10] found a net substitution of land and capital for labour in United States agriculture between 1925 and 1968 (Table I). During this time s_L, the income share of labour as a per cent of gross farm income, declined from 37 to 22 per cent (Table A.2). However, labour's share of gross farm income never decreased by more than —1.7 per cent per year.

Yamada and Hayami [16] estimated that, in Japan, labour's share of gross farm income changed from 49.7 to 49.4 per cent between 1910 and 1965. The maximum percentage annual rate of change in gross agricultural revenue was about 0.5 per cent per year.

Hsieh and Lee [7] estimated that in Taiwan s_L increased slightly—from 25 to 27 per cent. Simultaneously, the share of gross farm income paid

10. It is recognized that changes in labour's income share depends on the bias of technological progress, the elasticity of substitution and on changes in the employment of other inputs relative to labour. For the purpose of this paper a statement that forces operate within agriculture which may cause labour's income share to increase or decrease must suffice. If technological progress is neutral, the sign of s_L depends on the elasticity of substitution and the rate of increase in employment of non-labour inputs. See Hertford [5], Kravis [8], and Lianos [10].

TABLE I—AVERAGE ANNUAL PERCENTAGE CHANGE IN LABOUR INCOME SHARE: JAPAN, TAIWAN, AND THE UNITED STATES, DECENNIAL INTERVALS, 1910-1965[1]

Year intervals	Japan[2]	Taiwan[3]	United States[4]
		(per cent change per year)	
1910/19—1920/29	0.49	—0.35	—
1920/29—1930/39	—0.08	—0.20	—0.78
1930/39—1940/49	0.21	0.90	—1.05
1940/49—1950/59		0.40	—1.69
1950/59—1960/69	—0.31	—0.51	—1.21

1. To illustrate the way $\hat{S}_L$ was estimated in the respective countries the procedure used to calculate the average annual $\hat{S}_L$ in Japan between 1910/19 and 1920/29 is described. Labour's income share between 1910/19 and 1920/29 was estimated to be 49.7 and 52.2 per cent, respectively (Table A.2, p. 18). The percentage change in S_L between these two periods was 5.1 per cent. The annual percentage change in S_L during this decennium was estimated by assuming the growth in labour's income share followed a pattern of constant proportional growth. The compound annual growth rate in labour's income share, therefore, was found by solving $S_{Lt} = S_{L0}(1 + \hat{S}_L)^t$ for $\hat{S}_L$ where S_{Lt}, S_{L0}, and t are 49.7, 52.2, and 10, respectively.

2. Adapted from Saburo Yamada and Yujiro Hayami, "Growth Rates of Japanese Agriculture, 1880-1965," Appendix p. 39, paper presented at Conference on Agricultural Growth in Japan, Korea, Taiwan and the Philippines, sponsored by the Food Institute, East-West Center and Economic Development Center of the University of Minnesota, Honolulu, Hawaii. February, 1973.

3. Adapted from S. C. Hsieh and T. H. Lee: Factors Associated with Differences and Changes in Agricultural Production in Underdeveloped Countries: Taiwan, Unpublished manuscript, 1965.

4. Adapted from Vernon W. Ruttan and Thomas Stout, "Regional Differences in Factor Shares in American Agriculture: 1925-1957," *Journal of Farm Economics*, Vol. 42, No. 1, February, 1960, p. 60, estimate B of "Factor Share Estimates for Labor" for the United States, gross income basis; and Theodore P. Lianos, "The Relative Share of Labor in United States Agriculture, 1947-1968, *American Journal of Agricultural Economics*, Vol. 53, No. 3, August, 1971, pp. 411-422. Table 1, "S_L".

to land (s_A) declined from 62 to 41 per cent, and the share of gross farm income paid to capital (s_K) increased from 12 to 32 per cent. At no time during this period did labour's share of gross farm income change by more than ± 1.0 per cent per year.

By comparing the estimated values of $\hat{S}_L$ for these countries, it appears reasonable to use values between ± 1.0 for $\hat{S}_L$ in the estimation model.[1]

11. Theoretically, the size of $\hat{S}_L$ depends on the magnitude of the elasticity of substitution and the biasness of technological change. If the elasticity of substitution between two inputs is unity, and technical change is unbiased, the percentage changes in the quantity and price of labour, relative to other inputs, will be off-setting and relative income shares will not change. Kravis [8, p. 940] demonstrates that, "even with fairly large departures from unity, factor substitution may confine share shifts to fairly narrow limits." While this demonstration discounts the influence of bias in technological progress on resource allocation, he goes on to show that, "with a 75-25 division of national income between labour and capital, a 20 per cent increase in the ratio of the price of labour to the price of capital would not cause the labour share to stray more than 3 or 4 percentage points from 75 were the elasticity of substitution as low as 0.25 or as high as 2." The bias of technological progress will, depending on the direction of bias, further exaggerate or reduce the change in labour's income share.

It is interesting to note that in American agriculture, where labour's income share declined substantially between 1925 and 1968, the elasticity of substitution for labour was 1.5 and technological progress was capital augmenting. [10, p. 419]. In Japan, however ,the elasticity of substitution between capital and labour was consistently less than unity. [14, p. 146]

In Japan and Taiwan, where s_L did not change appreciably over the 50-year period, the estimated value of $\hat{s}_L$ was less than 1.0 during all intervals of the period. Only in the United States did the estimated value of $\hat{s}_L$ exceed —1.5 for some intervals of the period. However in the United States s_L decreased substantially and consistently during the entire period. Particularly, during the 1930's to the 1960's in the United States capital substituted for a rapidly declining farm labour force. Factors which would tend to encourage a similar rate of substitution of capital for labour do not seem to be present to the same degree in the densely populated developing Asian countries, and will likely keep $\hat{s}_L < |1.0|$.[12]

ESTIMATED RATES OF ANNUAL GROWTH IN TOTAL AND PER CAPITA INCOME TO FARM LABOUR

Having established approximate limits on the probable values of $\hat{Y}$ and s_L, these can be inserted into the predictive framework to estimate the total and per capita rates of growth in income and employment for farm labour. The annual percentage change in total income to farm labour may be derived directly from equation 8 ($\hat{s}_L = \hat{w} + \hat{q} - \hat{Y}$). The annual change in total income to farm labour, $\hat{L}$, is $\hat{w} + \hat{q}$. Isolating $\hat{w} + \hat{q}$ from the remaining portion of equation 6, the estimating model is :

$$(9) \quad \hat{L} = \hat{w} + \hat{q} = \hat{Y} = \hat{s}_L.$$

Table II presents the estimated rates of growth in total income to farm labour, $\hat{L}$, for alternative assumed magnitudes of $\hat{Y}$ and $\hat{s}_L$. Magnitudes for $\hat{Y}$ and $\hat{s}_L$ used to derive these estimates comprise the range of probable magnitudes as developed in previous sections of the paper. Magnitudes for $\hat{Y}$ range from 3.25 to 4.25 per cent, $\hat{s}_L$ varies from —1.0 to 1.0 per cent. Ranging from the most pessimistic assumed values of $\hat{s}_L$ and $\hat{Y}$ to the most optimistic, $\hat{L}$ ranges between 2.75 and 5.75 per cent annually. Using moderate assumptions ($\hat{s}_L = 0$ and $\hat{Y} = 3.75$) total income to farm labour is estimated to grow by 3.75 per cent per year.

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12. Data from several areas in India tend to support the hypothesis that the annual change in labour's share of total farm income would probably not exceed $\pm$ 1.0 per cent. Reports from the series, Studies in the Economics of Farm Management, published by the Ministry of Food and Agriculture Government of India for years from 1954 to 1964 for various regions in India show that labour's share of total income from farm production is about 30 to 35 per cent. Because labour's share is already relatively low it seems unlikely that labour's share of total farm income will decrease by more than 1.0 per cent per year.

TABLE II.—ESTIMATED ANNUAL RATES OF INCREASE IN INCOME TO FARM LABOUR ($\hat{L}$) IN INDIA FOR ALTERNATIVE ASSUMED MAGNITUDES OF $\hat{Y}$ AND $\hat{S}_L$

$\hat{S}_L$ (per cent)	Assumed values of $\hat{Y}$ (per cent)		
	3.25	3.75	4.25
— 1.0	2.25	2.75	3.25
— 0.5	2.75	3.25	3.75
0	3.25	3.75	4.25
0.5	3.75	4.25	4.75
1.0	4.25	4.75	5.25

The farm labour force continues to grow, however. Increments in total income to farm labour must be divided among a farm labour force which is growing by about 1.8 per cent annually. [1, p. 2] To obtain the estimates of the per capita rate of growth in income to farm labour, estimates of $\hat{L}$ are adjusted to reflect increases in the labour force among which it must be divided. This adjustment was accomplished by subtracting the annual percentage increment in the farm labour force, $\hat{N}$, from $\hat{L}$ (Table III). That is, $\hat{L} - \hat{N} = \hat{Y} - \hat{N} + \hat{S}_L$. Magnitudes of $\hat{N}$ considered include 1.6, 1.8, and 2.0 per cent.

TABLE III—ESTIMATED ANNUAL PERCENTAGE INCREASES IN PER CAPITA INCOME FOR FARM LABOUR FOR INDIA: ALTERNATIVE ASSUMED MAGNITUDES OF $\hat{Y}$, $\hat{S}_L$, AND $\hat{N}$

$\hat{S}_L$ (per cent)	Assumed values of $\hat{Y}$ (per cent)								
	3.25			3.75			4.25		
	Assumed values of $\hat{N}$ (per cent)			Assumed values of $\hat{N}$ (per cent)			Assumed values of $\hat{N}$ (per cent)		
	1.6	1.8	2.0	1.6	1.8	2.0	1.6	1.8	2.0
	(*Values of $\hat{L}$ per capita, per cent*)								
−1.0	0.65	0.45	0.25	1.15	0.95	0.75	1.65	1.45	1.25
−0.5	1.15	0.95	0.75	1.65	1.45	1.25	2.15	1.95	1.75
0	1.65	1.45	1.25	2.15	1.95	1.75	2.65	2.45	2.75
0.5	2.15	1.95	1.75	2.65	2.45	2.25	3.15	2.95	2.75
1.0	2.65	2.45	2.25	3.15	2.95	2.75	3.65	3.45	3.25

Ranging from the most pessimistic to the most optimistic assumptions, per capita increases in income to farm labour range from 0.25 to 3.65 per cent annually. When mid-range magnitudes for $\hat{Y}$, $\hat{s}_L$, and $\hat{N}$ are assumed the projected per capita increase in income to farm labour is 1.95 per cent annually.

ESTIMATED RATES OF ANNUAL GROWTH IN TOTAL AND PER CAPITA EMPLOYMENT IN AGRICULTURE

As discussed earlier, most remedies for the low income problem in developing agricultural sectors emphasize the importance of increasing employment opportunities. The framework used above is modified to project total and per capita percentage increments in farm employment for alternative assumed magnitudes of $\hat{Y}$, $\hat{s}_L$, $\hat{w}$, and $\hat{N}$. As before, the determinations stem from calculations based on equation 9. In what follows, however, $\hat{w} + \hat{q}$ is substituted for $\hat{L}$, and $\hat{q} = \hat{Y} + \hat{s}_L - \hat{w}$.

Projected rates of change in total farm employment are presented in Table IV. Assumed magnitudes of $\hat{Y}$ and $\hat{s}_L$ range from 3.25 to 4.25 and from

TABLE IV—ESTIMATED ANNUAL PERCENTAGE INCREASES IN TOTAL FARM EMPLOYMENT IN INDIA: ALTERNATIVE ASSUMED MAGNITUDES FOR $\hat{Y}$, $\hat{s}_L$, $\hat{w}$

$\hat{s}_L$ (per cent)	Assumed values of $\hat{Y}$ (per cent)								
	3.25			3.75			4.25		
	Assumed values of $\hat{w}$ (per cent)			Assumed values of $\hat{w}$ (per cent)			Assumed values of $\hat{w}$ (per cent)		
	0	0.5	1.0	0	0.5	1.0	0	0.5	1.0
	(Values of $\hat{q}$, per cent)								
—1.0	2.25	1.75	1.25	2.75	2.25	1.75	3.25	2.75	2.25
—0.5	2.75	2.25	1.75	3.25	2.75	2.25	3.75	3.25	2.75
0	3.25	2.75	2.25	3.75	3.25	2.75	4.25	3.75	3.25
0.5	3.75	3.25	2.75	4.25	3.75	3.25	4.75	4.25	3.75
1.0	4.25	3.75	3.25	4.75	4.25	3.75	5.25	4.75	4.25

—1.0 and 1.0, respectively. Assumed increments in farm wages ($\hat{w}$) are 0, 0.5, and 1.0 per cent per year. Increments in total farm employment range from 1.25 to 5.25 depending on the assumptions made. Total employment is estimated to increase by 3.75 per cent if $\hat{s}_L = 0$, $\hat{Y} = 3.75$, and $\hat{w} = 0$. That is, with no increase in wages, employment increases by an amount equivalent to the projected rate of increase in income to farm labour for the mid-range assumptions in Table II.

However, if wages increase by, say, 0.5 per cent per year the rate of increase in employment for farm labour will be less than the rate of increase in income to farm labourers. In this event increases in incomes to farm labourers will be concentrated among a portion of the current income earners rather than diffused among the total farm labour force.[13]

Also increases in farm wages ($\hat{w} > 0$) will tend to cause $\hat{s}_L$ to decline. This is so because, in terms of this analysis, $\hat{w} > 0$ implicity refers to an increase in the price of labour relative to other inputs. Consequently, when $\hat{w} > 0$ farmers are encouraged to substitute other inputs for labour. With $\hat{w}$ equal to, say 0.5, $\hat{s}_L$ would more likely be —0.5 than +0.5. With this combination of assumptions—$\hat{Y} = 3.75$, $\hat{w} = 0.5$, and $\hat{s}_L = -0.5$—, the annual rate of increase in employment is 2.75 per cent.[14]

Per capita changes in farm employment can be obtained by adjusting estimated $\hat{q}$ (Table IV) for increases in the farm labour force. Per capita changes in farm employment are calculated only for the most probable rate of change in the farm labour force—1.8 per cent (Table V). Alternative magnitudes for $\hat{Y}$, $\hat{s}_L$, and $\hat{w}$ correspond to those used in Table IV. Projected per capita increases in farm employment range from —0.55 to 3.45 per cent. Moderate assumed magnitudes for $\hat{Y}$, $\hat{s}_L$, $\hat{N}$ and $\hat{w}$ assumed equal to zero project a 1.95 per cent per capita increment in farm employment. However, if farm wages increase by 0.5 per cent annually, the annual percentage per capita increase in farm employment is only 0.95 per cent, when $\hat{Y} = 3.75$ and $\hat{s}_L = -0.5$.

13. Income opportunities may not be widely diffused over the entire farm labour force even if all of the annual increment in income results from increased employment. It is possible, and in many cases probable, that much of the increased employment represented by $\hat{q}$ will go to persons already employed rather than to new entrants into the farm labour force.

14. Also if these assumptions prevail the rate of increase in income to farm labour decreases from 3.75 to 3.25 per cent (Table II). Likewise, the per capita rate of increase in income to farm labourers is 1.45 per cent (Table III).

TABLE V—ESTIMATED ANNUAL PERCENTAGE INCREASES IN PER CAPITA EMPLOYMENT FOR FARM LABOUR IN INDIA: ALTERNATIVE ASSUMED MAGNITUDES OF $\hat{Y}$, $\hat{S}_L$, $\hat{w}$ and $\hat{N}$ at 1.8

$\hat{S}_L$ (per cent)	Assumed values of $\hat{Y}$ (per cent)								
	3.25			3.75			4.25		
	Change in farm wages (per cent)			Change in farm wages (per cent)			Change in farm wages (per cent)		
	0	0.5	1.0	0	0.5	1.0	0	0.5	1.0
	(*Values of* $\hat{q}$ *per capita* (*per cent*)								
—1.0	0.45	—1.05	—0.55	0.95	0.45	—0.05	1.45	0.95	0.45
—0.5	0.95	0.45	—0.05	1.45	0.95	0.45	1.95	1.45	0.95
0	1.45	0.95	0.45	1.95	1.45	0.95	2.45	1.95	1.45
0.5	1.95	1.45	0.95	2.45	1.95	1.45	2.95	2.45	1.95
1.0	2.45	1.95	1.45	2.95	2.45	1.95	3.45	2.95	2.45

IMPLICATIONS FOR INCOME AND EMPLOYMENT GENERATION AND DISTRIBUTION IN AGRICULTURE

In India and other developing Asian countries, limits on the rate of growth in the demand for farm products seem likely to cause the per capita rate of growth in *income* to farm labour to about 1.95 per cent—unless the farm labour force grows by less than 1.8 per cent per year or unless the income share paid to farm labour increases simultaneously. Assuming no change in the level of real farm wages, the projections also indicate the probable per capita rate of increase in farm *employment* at about 1.95 per cent. Decreases in labour's income share and/or increases in the level of farm wages will reduce the per capita rate of increase in farm employment to less than 1.95 per cent.

The foregoing projections suggest that prospects for increasing per capita labour incomes and employment in agriculture are limited. The analysis indicates that income and employment gains are to be achieved by increasing $\hat{Y}$ and $\hat{s}_L$ and restraining $\hat{N}$ and $\hat{w}$. Particular attention needs to be focused on means to increase $\hat{s}_L$ and restrain $\hat{w}$.[15]

15. This is not to make light of the importance of increasing $\hat{Y}$ and reducing $\hat{N}$. These are not emphasized here because much has already been said about the need to restrain population growth ($\hat{N}$) and the desirability, from a growth standpoint of maintaining a high rate of increase in aggregate demand ($\hat{Y}$).

Emphasis is focused on $\hat{s}_L$ because the direction and rate of change in labour's income share can add to or subtract from the per capita rate of growth in income to farm labour and employment stemming from a general increase in income to all factors of farm production. In Japan and Taiwan the income share paid to farm labour increased and remained constant, respectively. Many of the reasons for the change or lack of change in labour's income share include factors which lie beyond the scope of this paper. Significant, however, is the fact that agricultural hardware of the type now available in many developing Asian countries was not available to farmers in Japan and Taiwan. Further in Japan and Taiwan, a relatively equal distribution of small land holdings eliminated many possibilities for economies of scale, and decreased the demand for agricultural hardware. Less egalitarian distribution of land, greater possibilities for economies of scale, and various fiscal measures which tend to cheapen farm implements increase the possibilities of substituting capital for labour in the farm sector in India and other Asian countries. Within limits, government agencies can regulate the rate and degree to which capital substitutes for labour in agriculture. In many instances overt action may be necessary to prevent excessive capital substitution for labour which may result in a decline in the income share paid to farm labour.

The foregoing analysis suggests that, in a developing economy where a relative shortage of employment opportunities is a major cause of rural poverty, the rate of growth in income to farm labour is likely to be greater and more widely distributed when the increase in income to farm labour results from increases in employment rather than wages. This pattern of growth will occur automatically if the economy conforms to standard conceptions of a "surplus" labour economy. That is, additional labour can be obtained from the existing labour force with no increase in farm wages. Such generic representations are deceiving, however, because the existence of "surplus" labour is specific with respect to time and space, and labour markets can make only imperfect adjustments over time and space. New stimuli for increases in farm production (high-yield seeds for example) increase the demand for farm energy at particular times of the year. At these times additional labour may be able to be obtained by farmers only at wages greater than those which previously prevailed. Also, spatial disparities in the rate of agricultural development cause regional variations in the rate of increase in demand for farm energy. Labour from deficit employment areas may not move into areas where the demand for labour is greater. This regional immobility of farm labour may cause farm wages to increase in a rapidly developing region while "surplus" labour may exist in an adjoining region. These and other related factors, therefore, may cause farm wages to increase to the detriment of the growth in farm employment. Moreover, inflexibilities of this type in the demand for energy and the supply of labour may foster capital substitution for labour and tend to decrease labour's income share. Consequently, to the extent that the market for farm labour can be made more responsive to changes in the demand for labour over time or space, the

rate of increase and distribution of income to farm labour will also increase.

This analysis has not considered the effect of institutional and other forces which influence the distribution of labour income and employment among the labour force itself. To the extent t] at these forces exist within the economy, public authorities will be required to monitor these forces carefully, if income and employment benefits are to be distributed widely. Such monitoring is not as important when total income to labour is growing rapidly relative to population. However, they become much more important and difficult when that which is to be distributed is growing slowly relative to those among whom it must be divided.

Finally, with moderate rates of agricultural development, the farm sector can provide modest increases in per capita income and employment. The agricultural sector has an important role to play in increasing income and employment opportunities in the developing country. However, increased income and employment opportunities are required in urban and rural non-farm occupations if per capita incomes and employment are to increase throughout the country.

APPENDIX

TABLE A.1—RELATIVE IMPORTANCE OF FARM PRODUCED COMMODITIES IN CONSUMPTION, INCOME ELASTICITIES OF DEMAND BY COMMODITY, AND WEIGHTED AVERAGE INCOME ELASTICITY OF DEMAND FOR FARM PRODUCTS, BY SECTOR: INDIA, 1960 APPROXIMATELY

Economic sector and item	Item as proportion of all farm products consumed[a]	Income elasticity of demand[b]	Weighted income elasticity of demand for farm products for rural and urban sector	
	(1)	(2)	(3)	
Rural				
Foodgrains	0.52	0.52	(0.27)[c]	
Milk and milk products .. .	0.09	1.60	(0.14)	
Other food	0.29	0.85	(0.24)	
Non-food	0.10	0.70	(0.07)	
Total	1.00	—	0.73	Income elasticity for farm products (rural)
Urban				
Foodgrains	0.34	0.28	(0.10)	
Milk and milk products ..	0.14	1.20	(0.17)	
Other food	0.42	0.85	(0.36)	
Non-food	0.10	0.80	(0.07)	
Total	1.00	—	0.70	Income elasticity for farm products (urban)

a. Derived from Government of India, Tables with Notes on Consumer Expenditure, National Sample Survey, Eighteenth Round, February, 1963 to January, 1964, No. 142, Cabinet Secretariat, 1968, pp. 56, 129.

b. Income elasticities of demand for foodgrains come from John Mellor and Uma Lele: Estimates of Change and Courses of Change in Food Grains Production, India, 1949-50 to 1960-61, Cornell International Agricultural Development Bulletin 2, Cornell University, Ithaca, 1964, p. 11; those for milk are from John Mellor and Uma Lele, "Growth Linkages of the New Foodgrain Technologies," Draft, 1972, p. 17 [Revised paper published in *Indian Journal of Agricultural Economics*, Vol. XXVIII, No. 1, January-March, 1973]; and those for other food and non-food come from National Council of Applied Economic Research: Long-Term Projections of Demand for and Supply of Selected Agricultural Commodities, New Delhi, 1962, p. 85. The income elasticities reported for "other food" and "non-food" are for edible oils and mill-made clothing, respectively.

c. Items in parentheses are the individual numerical components of the "weighted average income elasticity of demand for farm products."

TABLE A.2—SHARE OF GROSS AGRICULTURAL INCOME PAID TO LABOUR, LAND, AND CAPITAL FOR THE UNITED STATES, TAIWAN, INDIA, AND JAPAN: DECENNIAL INTERVALS, 1910 TO 1960

(per cent)

Decennial intervals	Labour				Land				Capital			
	United States[1]	Taiwan[2]	India[3]	Japan[4]	United States	Taiwan	India	Japan	United States	Taiwan	India	Japan
1910—19	—	26.5	—	49.7	—	61.8	—	29.7	—	11.8	—	21.0
1920—29	37.3	25.6	—	52.2	17.0	56.9	—	26.4	45.7	17.4	—	21.4
1930—39	34.5	25.1	—	50.9	15.6	52.3	—	25.7	49.9	22.6	—	23.4
1940—49	31.0	27.3	—	—	7.0	57.0	—	—	62.0	15.7	—	—
1950—59	26.6	28.4	34.0	52.0	10.7	45.8	27.5	22.6	62.7	25.6	38.5	25.0
1960 plus	23.2	27.0	—	49.4	—	41.0	—	20.3	—	32.0	—	30.0

1. Estimates through 1959 were taken or adapted from Vernon W. Ruttan and Thomas Stout, "Regional Differences in Factor Shares in American Agriculture : 1925-57," *Journal of Farm Economics*, Vol. 42, No. 1, February, 1960, pp. 52-68. After 1959 the labour share estimate for the United States is from Theodore P. Lianos, "The Relative Share of Labor in United States Agriculture, 1949-1968," *American Journal of Agricultural Economics*, Vol. 53, No. 3, August, 1971, pp. 411-422.

2. Adapted from S. C. Hsieh and T. H. Lee: Factors Associated with Differences and Changes in Agricultural Production in Underdeveloped Countries: Taiwan, Unpublished manuscript, 1965.

3. S. V. Sethuraman: Long Run Demand for Draft Animals in Indian Agriculture, Unpublished Ph. D. dissertation, University of Chicago, Chicago, 1969, p. 64.

4. Adapted from Saburo Yamada and Yujiro Hayami, "Growth Rates of Japanese Agriculture, 1880-1965," Appendix p. 39, paper presented at Conference on Agricultural Growth in Japan, Korea, Taiwan, and the Philippines, sponsored by the Food Institute, East-West Center and Economic Development Center of the University of Minnesota, Honolulu, Hawaii, February, 1973.

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(13) Vernon W. Ruttan and Thomas T. Stout, "Regional Differences in Factor Shares in American Agriculture: 1925-1957," *Journal of Farm Economics*, Vol. 42, No. 1, February, 1960, pp. 52-68.

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(15) Sidney Weintraub : An Approach to the Theory of Income Distribution, Chilton Company, Philadelphia, U. S. A., 1958.

(16) Saburo Yamada and Yujiro Hayami, "Growth Rates of Japanese Agriculture, 1880-1965," paper presented at Conference on Agricultural Growth in Japan, Korea, Taiwan, and the Philippines, sponsored by the Food Institute, East-West Center and the Economic Development Center of the University of Minnesota, February, 1973.