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RURAL-URBAN MIGRATION, AGRICULTURAL OUTPUT, AND THE SUPPLY
PRICE OF LABOR IN A LABOR SURPLUS ECONOMY

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Rural-Urban Migration, Agricultural Output, and the Supply

Price of Labor in a Labor Surplus Economy

In the development literature a great deal of discussion and research has been focused, within the framework of a dual economy, on the value of the marginal product of labor in the agricultural sector and on the characteristics of the labor supply curve facing the modern or industrial sector. Over time, two points of view have emerged. The first, whose origins go back to the work of Nurkse [8] and Lewis [6], and which has most recently been restated by Fei-Ranis [1], is that there is a large "redundant" labor force in the agricultural (traditional) sector. The proponents of this view conclude:

(a) that the marginal product of labor in agriculture is zero

(b) that the withdrawal of labor from agriculture would leave total

agricultural output unchanged and

(c) that the supply curve of labor facing the industrial (modern)

sector is horizontal at a wage rate (in terms of wage goods--

assumed to be agricultural goods) approximately equal to the

average product of labor in the agricultural sector, plus

transfer costs.

Most holders of the opposing point of view have based their position primarily on recent direct empirical evidence. For example, Paglin [9] and Islam [2] argue that proposition (a) does not hold, therefore neither do (b) and (c). Jorgenson uses what might be called indirect empirical evidence to cast doubt on the existence of zero marginal productivity.[1]

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[1]Both Jorgenson and Fei-Ranis have alleged empirical evidence on the development of factor shares over time in Japan to support (indirectly) their respective contentions of positive and zero marginal productivity of labor in agriculture. In both cases the evidence (if the data are correct) is consistent

Mellor[1] [7] and Islam[2] [3] have questioned the link going from (a) to (b)

and (c) on more theoretical grounds.

In using empirical evidence to cast doubt on the existence of marginal

productivity of labor equal to zero, Paglin and Islam base their conclusions

on the fact that data for India and Pakistan have shown a strong and positive

correlation of labor input and output per acre in agriculture. Hence they

conclude that if the labor intensity of that land which is now relatively low,

were to be increased, total agricultural output would increase. Similarly,

if workers were withdrawn from agriculture, total output would decline. Such

a decline is not, on closer scrutiny, dependent on a positive marginal produc-

tivity of labor.

Indeed, as is shown below, one should expect output to fall when labor

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(Footnote 1 from preceding page continued)
with their assumptions but does not prove them.

Jorgenson's model [4] assumes that the marginal product of labor in agriculture is positive and hence that the transfer of labor from agriculture to the modern sector will require an increase in productivity if the terms of trade are not to be turned against the modern sector. Such a model lays great-er urgency on agricultural development as a part or prerequisite of industriali-zation. In our model, one can have a positive marginal product of labor in agriculture in the sense that agricultural output declines when labor is trans-ferred to the modern sector and yet, an "agricultural surplus" can be generated by appropriate tax policies.

[1]To the extent that we attempt to explain changes in aggregate variables (agricultural output and the supply curve of labor to the modern sector) by going back to the individual decision worker and his preference as expressed in utility maps, our model follows the precedent of Mellor [7]. Like him, we allow for a choice between goods and leisure. However, our model does not depend on the existence of "limited aspirations" or the assumption that the marginal utility of goods and services "drops substantially once subsistence is met," and is, in this respect, more general than his.

[2]Islam [3] stresses the importance of land tenure on the leakages of the "surplus" into additional per capita consumption in agriculture and on the effect of an increase in real income for the nonmigrants and the supply price of their labor. In other words, Islam recognizes that the existence of certain kinds of tenure systems may eliminate the Fei-Ranis Stage I.

is transferred from agriculture to the industrial sector regardless of whether the marginal product of labor in agriculture is zero or greater than zero, whenever the actual cultivators (peasants or agricultural workers) can exercise any independent choice in terms of the distribution of their time between work and leisure.

Because Fei and Ranis <u>assume</u> that the existence of zero marginal productivity of labor in agriculture implies that total agricultural output remains unchanged when workers are transferred to the urban sector, they focus on how this "surplus" can be channelized into productive investment. For them, the important variable is the choice by the recipients of the agricultural surplus between consumption and saving. The role of government is seen as being one of various ways in which the agricultural surplus can be kept out of additional consumption and channelized into investment. For most land tenure systems we show below that government action is, under most reasonable assumptions about the indifference curves of peasants, absolutely necessary to insure that agricultural output does not fall when labor is transferred to the modern sector. The first stage of the Fei-Ranis model, that of labor redundancy, would therefore not exist in the presence of passive government policies with respect to the agricultural sector. As soon as workers moved to the modern sector agricultural output would fall and agricultural prices would rise relative to prices of manufactured goods.

The third phenomenon we discuss is the supply curve of labor to the modern sector. The supply price refers to the amount which the modern sector must pay in terms of wage goods to obtain a unit of labor. Fei-Ranis assume that given a zero marginal product of labor in agriculture output remains constant when workers move to the modern sector, and the wage rate per unit of labor time is equal to the "institutionally determined" wage in the agricultural sector. The

supply curve facing the modern sector is horizontal (parallel to the labor-axis) at a height equal to the agricultural wage plus transfer costs until the marginal product of labor in agriculture reaches the institutional wage rate, at which point the supply curve bends upward.

One ambiguity which persists throughout most of the literature on labor surplus economics is the time dimension applied to the wage rate, i.e., whether it is a per day or a per hour rate. It is often implicitly assumed that such a distinction is unimportant. Suppose however, that workers are indifferent to working in agriculture or industry (i.e., assume no transfer costs); then even if the total wage per day worked is the same in the two sectors, a worker will not be indifferent unless the number of hours worked per day is also the same in each sector. If there is redundant labor in agriculture then the aver-age number of hours worked per day must be relatively small in comparison with the work day prevailing in industry (the latter does not usually reflect the number of workers available but is customarily set at eight to ten hours per day). Does this mean that the hourly wage rate in industry must (neglecting transfer costs) be equal to the hourly wage rate in agriculture? The answer is, in general, no. The wage rate at which agricultural labor is willing to move to the modern sector depends on the shape of individual utility functions as well as the average hourly wage rate in agriculture.

In what follows we show that since Stage I of the Fei-Ranis model does not, except under unusual circumstances, exist (in the absence of definite government policies), and the supply curve of labor facing the modern sector is, except under these unusual circumstances, upward sloping. The y-intercept however, is not in general equivalent to the agricultural wage rate. It may be below, equal to, or above it, according to the case.

To sum up, we show that the interrelationships which have usually been

assumed among propositions (a) to (c) above are not strictly correct and have
led to a great deal of confusion.

I. Assumptions and Definitions

In order to simplify the exposition and analysis, we have used a simple two
sector model of the economy. In the agricultural or traditional sector we as-
sume that each peasant consumes only agricultural goods (which we identify as
food) produced by himself. The alternative to consuming more food is to work
less and consume more leisure. Leisure can be defined broadly to include all
activities which, when undertaken, do not in themselves augment the quantity of
food available for consumption.

Other assumptions are:

1. Constant returns to scale. If land, labor, seeds, fertilizers,
etc., are increased proportionately, then output rises in the same proportion.

2. Homogeneity of inputs. Each unit of labor input by the same
worker is of equal "efficiency." Also, the efficiency of labor input is not
a function of food intake.[1] Finally, all land is of equal fertility.

3. Existence of leisure. Everyone is consuming some leisure (ex-
cluding the time required for sleeping, eating, etc.).

4. Distribution of factors. For analytical purposes it is con-
venient to assume that land and other nonhuman resources are distributed uni-
formly over the entire agricultural population, or over some sub-set of that
population such as adults or adult males from which labor time is or poten-
tially could be forthcoming. This assumption aids in the clarification of
distinctions among different situations which might prevail in the agricultural
sector. The modifications required to take account of unevenness of distribu-

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[1]See Leibenstein [5] and Wannacott [10] for models where labor produc-
tivity is a function of food consumption.

We define the <u>subsistence wage rate</u> (W_s) as the average return per unit time to labor input which, given the total land availability, agricultural labor force and institutional framework, is just sufficient to give the agricultural worker the subsistence level of income.

II. Framework of the Analysis

Using the above assumptions and definitions we can now proceed to outline the framework within which our analysis will proceed.

The Indifference Map of a Representative Agricultural Worker

In Figure 1 we show the several possible types of indifference curves for a representative worker in the agricultural sector. The quantity of "food" consumed per unit time is plotted on the vertical (y) axis, while the number of leisure hours consumed per unit time is plotted on the horizontal (X) axis. OX_o represents the maximum number of leisure hours which are available. OS measures the minimum or subsistence level of food consumption necessary to sustain life. The set of food-leisure consumption combinations represented by the area lying above the line SS' and between the vertical axis and the line rising vertically from the point X_o is the set of consumption points which the worker could theoretically ever choose. In this sense it is the "potentially feasible" consumption set.

The indifference curves lying within the "potentially feasible" set of consumption points have the usual shape and properties. For our purposes we distinguish among those which:

i) intersect the line SS' . (Cf. indifference curve I in Figure 1.) For these indifference curves the marginal rate of substitution of leisure for food (MRS_{xy}) is discontinuous at the point of intersection, where it suddenly becomes equal to zero.
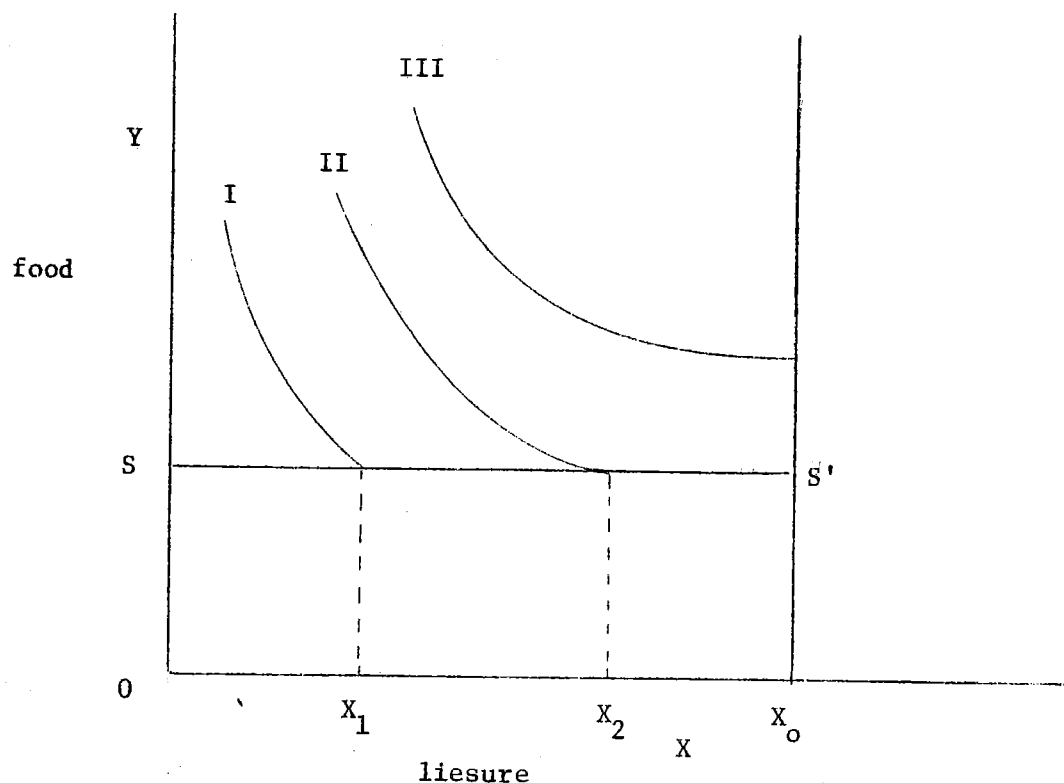
ii)   are tangent to the line SS' (cf. II). They may be tangent at the

point X_0 or along a whole segment beginning at some point such as X_2 . At

the points of tangency, $MRS_{xy} = 0$; the agricultural worker is not willing to

give up any food for additional leisure--not because doing so would result in

death (as in the above case), but because additional leisure would yield zero

utility. In other words, with OX_2 units the worker is satiated with leisure.

At least one curve must be of either the first or second type.

iii) do not touch the line SS' at all (cf. III).

The Transformation Curve

The "potentially feasible" set includes all those consumption points which

the consumer might ever voluntarily choose. At any point in time, how-
ever, there is a set which is "currently feasible." This set is determined
by the physical resources (land, equipment, fertilizers, seeds, etc.) which
the worker has at his disposal and by institutional constraints which deter-
mine the division of total product between worker and land owner.

At each point in time the total cultivated land is, by our assumption,
distributed among the existing stock of agricultural workers so that each has
a fixed and equal amount of land. The total output of food produced by a
worker is a function of the amount of labor time he applies to his land.[1]
The function which relates total product to inputs of one factor, when all
other factors are held constant, is the familiar total product curve. How-
ever, not all of total product need accrue to the agricultural worker. If
we wish to specify the set of "currently feasible" consumption points we must
relate the amount of food which the worker can consume with varying amounts
of inputs of labor time.

We denote the upper boundary of the "currently feasible" set of consump-
tion points to be the transformation curve. It shows the maximum amount of
food which the worker can get for each amount of labor input, given the quan-
tity of nonlabor resources he has to work with and given the institutional
framework.

The transformation curve will have the general shape of the curve DAG
in Figure 2. Labor input (or leisure foregone) is measured from right to
left with G as the origin. The slope of the transformation curve (the mar-
ginal rate of transformation) decreases as the worker applies more labor to
the given amount of land. At some point such as A where the worker is
supplying $G-X_1$ units of labor, it is assumed that the marginal rate of
transformation of leisure into food (MRT_{xy}) becomes zero. Alternatively

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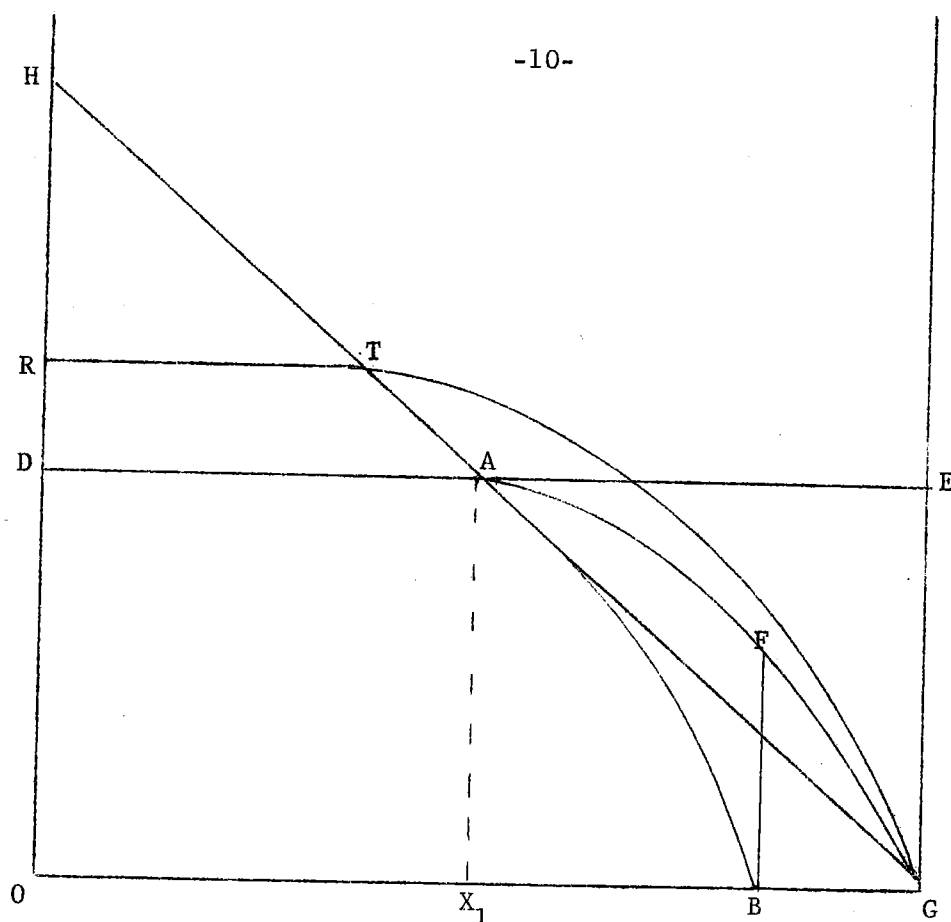[1]For the sake of simplicity we neglect other variable inputs.

Figure 2

$MRT_{xy} = 0$ for all X such that $OX < OX_1$.

The transformation curve is derived from and, under most institutional arrangements, has properties similar to the workers total product curve. Diminishing MRT (as one moves from right to left) is comparable to diminishing marginal physical product as more and more units of labor time are added to the given land area. The point at which $MRT_{xy} = 0$ is likely to be equivalent to the point where the marginal physical product of labor time is equal to zero.

The general characteristics of the transformation curve are invariant to most institutional settings which prevail in the agricultural sector of developing economies. Three of the most common settings are the following:

i) Peasant proprietorship, where the peasant owns his land and receives the total product of his labor. The workers' transformation curve is equivalent to his total product curve. The total amount of leisure that the

worker could consume, OG, is equal to the total number of leisure hours available, OX_O. At point A in Figure 2 with OG-OX units of labor input, the marginal product of labor is zero. At this point the worker would never apply more labor unless he was satiated with leisure. Hence the relevant segment of the transformation curve is AG.

ii) Share cropping, under which the peasant and landowner share the total product according to some predetermined ratio. In this case, the transformation curve is obtained by subtracting a fixed proportion from output for each level of labor input. When labor inputs are zero, total food consumption must also be zero. The labor input at which the marginal return in terms of food to the worker is zero is the same level at which the marginal product of labor is zero.

iii) Tenant farming, under which land rent is a fixed amount and is independent of the level of output. In this case the transformation curve is below and parallel to the total product curve, the distance between them representing the fixed land rent. In this case $OG < OX_O$ (where OX_O = total number of leisure hours available) and (OX_O - OG) is the number of hours of labor input which the worker must put in in order to pay his landlord the fixed rent.

A fourth institutional framework is that of wage labor where the agricultural worker neither owns nor rents land but is employed by someone who does. There is no generally definable transformation curve facing the worker since his precise hours and salary could be fixed by the employed, in which case the curve would have been collapsed into a point. Alternatively the hours and salary might be a subject of bargaining, in which case, although there is more than one possible outcome for the worker, no transformation curve can be defined.

Where the hourly wage is fixed and the worker is free to choose the number of hours, the transformation curve exists and is a straight line such as GH in Figure 2.

Either of two assumptions may be made about the determination of the wage rate in agriculture.

a) Employers are rational, profit maximizers can hire labor up to the point where marginal product is equal to the wage rate.

b) Because of tradition and custom, employers must hire more workers than would maximize their profits (i.e., must retain workers whose marginal productivity is below the subsistence wage level which is either physically or socially defined). The amount of labor input which the worker gives the employer is determined either by tradition or by bilateral bargaining between employer and worker. To the employer the subsistence income which he must guarantee the worker is a fixed cost so it is in his interest to have the employee work up to the point where the marginal product of labor inputs is zero.

Given the number of hours input, an implicit wage equal to the subsistence income divided by hours worked can be defined for either of the above cases. Where the worker can choose the number of hours and the hourly wage is fixed, the wage rate is given by the slope of the transformation curve. For the other three institutional forms the wage rate and the transformation curve have a different interpretation; there is no definable locus of points from which the worker can freely choose.

III. The Implications of Transference of Workers to the Modern Sector

Most economists who believe that the marginal product of labor in agriculture is zero argue that, consequently, total agricultural output will remain constant when workers are moved out of agriculture into the modern sector. Conversely, those who believe in a positive marginal product conclude that total agricultural output will decline when workers are moved to the urban sector. In what follows we examine, under several alternative

assumptions about both the indifference and transformation curves of agricultural workers, the relationship between the marginal product of labor in agriculture and the effect on total agricultural output when labor is moved to the urban sector. We conclude that the output falls in almost all cases whether marginal productivity is equal to zero or greater. With likely assumptions about workers' indifference curves between food and leisure we find that those who remain in agriculture will not increase their inputs of labor time enough to completely offset the decrease in inputs of labor time resulting from the movement of some workers to the modern sector,[1] and hence agricultural output will fall.

The analysis also shows that the slope of the supply curve of labor facing the modern sector is, in general, positive. The frequent assertion that the minimum wage <u>rate</u> at which labor would move to the urban sector (i.e., the intercept of the supply curve) is equal to the average product of labor in agriculture (adjusted for transfer costs) proves to be invalid.

These questions are discussed under the assumption of peasant proprietorship. Later we show that the conclusions are not affected when the land tenure system is one of share cropping or tenant farming. They must be modified in the case of wage labor so this case is dealt with separately.

Under peasant proprietorship, as noted above, the transformation curve is identical to the total product curve. In Figure 2 then, the curve DAG is the transformation curve of the worker. The average product of labor inputs is given by the slope of a line connecting point G to the point on the total product curve corresponding to each amount of labor input.

If one worker is withdrawn from the agriculture sector then the land

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[1]It should be noted that in the original paper by Lewis [6] it was assumed that those remaining in agricultural sectors would in fact work harder to completely offset the loss of output caused by migration.

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which he was cultivating is by our previous assumption, distributed in some way among those workers who remain (all other variable inputs are also distributed-- say in proportion to land area).

When a worker receives more land his total product and transformation curve shifts upward to a new position such as RTG in Figure 2. The new curve has two noteworthy properties: i) it includes the point G (when labor inputs are zero, so is output) and ii) point T , where the marginal product of labor in- puts is equal to zero, implies the same average product of labor as point A (where marginal product was equal to zero under the original circumstances), due to the assumption of constant returns to scale.

We turn now to the specific cases to be dealt with.

Case I: Marginal product of labor is zero in agriculture and the workers are at the subsistence level.

Case II: Marginal product is zero but workers are above the subsistence level.

Case III: Marginal product is above zero.

Case I.   ($MP_L = 0$ and income is at the subsistence floor.)

In this case the worker must be at point A in Figure 2 where he is supplying OG - OX units of labor and consuming OS units of food.

The indifference curve reached by the worker at point A must either

i)   intersect the line SA at A ;

ii)   be tangent to the line SA along some segment of SA and including point A , or

iii) become tangent to the line SA at point A .

The effect of labor withdrawal on total agricultural output, depends on which of these relations the indifference curve bears to SA and on the shape of the transformation curve.

<u>Case I (i)</u>   At point   A $MRS_{xy} \geq W_s$

This case is shown in Figure 3. When workers are shifted out of agriculture the transformation curve of remaining workers shifts up to a new position such as RTG . Total agricultural output would be constant if the remaining workers increased their inputs of labor time to the point indicated by T . But the worker will not move to point T since it is on a lower indifference curve than points A or B ; he will, rather, choose on his new transformation curve, a point which is to the right of B , since it will be on a higher indifference curve than B . The remaining workers will thus not increase their inputs of labor time to offset the decline caused by the transfer of one worker to the modern sector. It is even conceivable that each remaining worker will decrease his total work effort and move to a point such as C . In either case, total agricultural output will fall when labor is withdrawn from that sector.

Initially, the agricultural worker was working to the point where his $MRT_{xy} = 0$. At this level of employment he was just able to earn a subsistence income. The implicit wage rate at which he was working is given by the slope of the line HG which in the case of peasant proprietorship is equal to his average product. At this subsistence wage rate (W_s) the worker is on his highest indifference curve supplying $OG - OX_1$, units of labor. Assuming that his indifference map does not change, the worker clearly would not work in the modern sector for any wage rate less than that given by the slope of HG . That is, the lowest price at which he would supply labor to the modern sector is equal to the slope of HG . As labor is withdrawn from agriculture those who remain will find that <u>ceteris</u> <u>paribus</u> their implicit wage rate will rise so that as labor is withdrawn from agriculture the supply price of those who remain will rise.
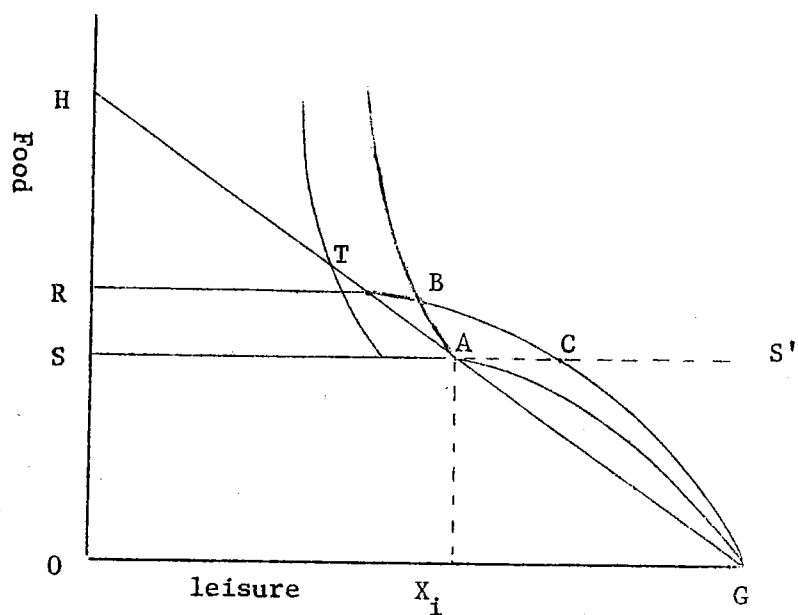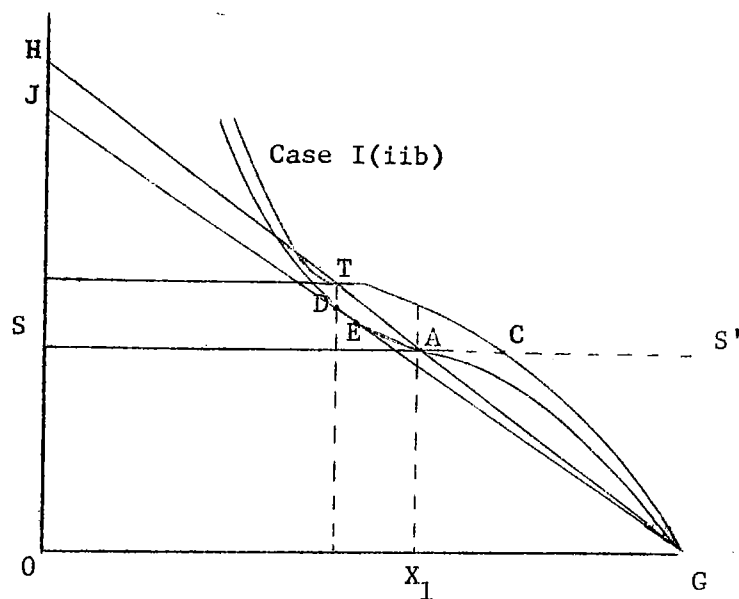
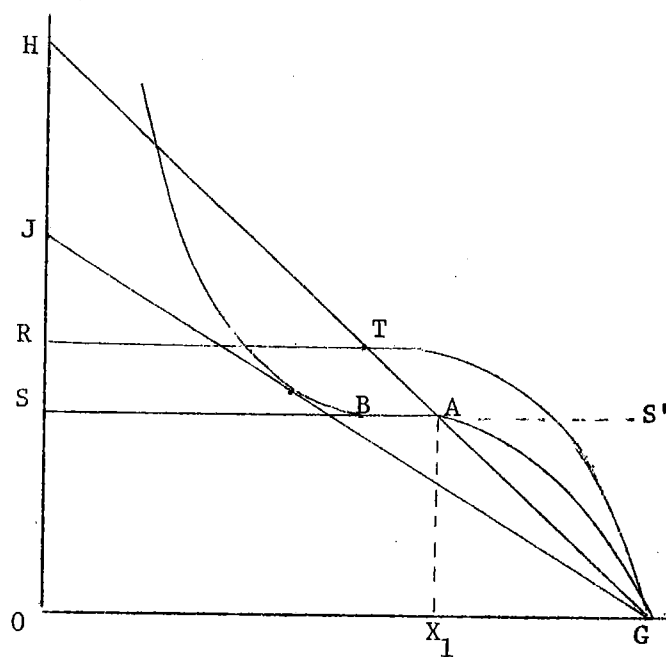Fig. 3   Case I (i)

Fig. 4   Case I (ii)

Fig. 5   Case I (iii)

<u>Case I (ii)</u>   At point A, $0 < MRS_{xy} < W_s$ or $MRS_{xy} = 0$ at and only at A .

This case is shown diagramatically in Figure 4.

Two conclusions can be drawn about the effect of labor withdrawal from agriculture depending on whether;

a) given the amount of leisure (X), the MRS_{xy} <u>does not decrease</u> as the amount of food (Y) increases,[1] or

b) MRS_{xy} does decrease as Y increases (i.e., there is increasing marginal utility of "food").

<u>Case I (iia)</u>   When labor is withdrawn from agriculture and the transformation curve of a representative worker who remains shifts up to a new position such as RTG , total agricultural output will decline because the worker will not move to point T . After the shift in the transformation curve, the worker will be in equilibrium either at a point of tangency between an indifference curve and the transformation curve or at the point C where both the indifference curve and the transformation curve intersect the line SS' . If the worker is in equilibrium at a point of tangency, that point must lie to the right of T since the $MRT_{xy} = 0$ at both A and T while the $MRS_{xy} > 0$ at point D which is a point at which the consumption of leisure is the same as T but the consumption of food is less. By assumption the MRS_{xy} at T cannot be less than MRS_{xy} at D .

<u>Case I (iib)</u>   When <u>ceteris paribus</u> the marginal utility of food increases as the amount of food consumed increases then it is possible that increased labor inputs by those remaining in agriculture will offset the decline through labor withdrawal. In other words, it is conceivable that the remaining workers could

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[1]This assumption is equivalent to saying that: holding the amount of leisure constant at any amount, the marginal utility of additional units of food will not increase.

be in equilibrium at point T with an indifference curve such as that shown in Figure 4, tangent to the transformation curve at point T . In this case total agricultural output will remain constant or decline depending on the shapes of indifference curves.

In both cases, ii(a) and ii(b), it is interesting to note that the worker is initially indifferent between points A and E where point E is the point of tangency between the indifference curve and the straight line JG . The worker is apparently willing to work at a wage (equal to the slope of the line JG which is below the subsistence wage rate in agriculture provided that he is able to work longer hours). Hence labor would initially be supplied to the modern sector at a wage rate below the subsistence wage rate (W_s).

Case I (iii) $MRS_{xy} = 0$ along a segment of the transformation curve.

Figure 5 graphically demonstrates this case. Indifference curve I is tangent to the transformation curve along the segment BA . When the transformation curve shifts to RTG it is possible that the new point of equilibrium will be at point T . That is, the highest indifference curve which the worker could reach, could be tangent to the new transformation curve at T . As the transformation curve continues to shift upward, the initial condition of leisure satiation will gradually disappear. When it does, Case ii) is similar to Case I (i) or I (ii).

While Case I (iii) is relevant, output may remain constant or decline when labor is withdrawn from agriculture. The initial supply price of labor to the modern sector is below the subsistence wage in agriculture (and is equal to the slope of the line JG) and rises as labor is withdrawn. The reason for this is similar to that for Case I (ii).

Case II   ($MP_L = 0$, workers above the subsistence level.)

In this case, the worker must be on an indifference curve tangent to the

transformation curve at the point where $\text{MRT}_{xy} = 0$. In this sense, Case II

is identical to Case I (ii). Assuming that given X, the MRS_{xy} does not

increase as Y increases, total agricultural output will fall when workers

are withdrawn. The minimum real wage at which workers will move to the modern

sector is below the implicit wage rate prevailing in agriculture.

Case III   ($\text{MP}_L > 0$)

Here we examine two possible cases:

i)   income is at the subsistence level. The worker could consume more

food if he were willing to forego additional leisure but he will not do so since

he would then be on a lower indifference curve.

ii)   income is at a level above the subsistence income.

Case III (i)

In this case at point A, $\text{MRS}_{xy} \geq \text{MRT}_{xy}$, that is, the amount of leisure

that the worker is willing to give up for an additional unit of food is less

than the amount of labor input which is necessary to produce one unit of food.

As labor is withdrawn from agriculture, the change in total amount of labor

supplied by remaining workers to the land will not rise proportionately to in-

crease in land per worker and hence total agricultural output will decline.

The supply price of labor to the modern sector is above the subsistence

wage rate. The intercept of the supply curve is equal to the initial AP_1 in

agriculture and is upward sloping.

Case III (ii)   In this case $\text{MRS}_{xy} = \text{MRT}_{xy}$ at the equilibrium point A. A

withdrawal of labor from agriculture (or an upward shift in the transformation

curve) will lead to a decrease in total output if we assume that the MRS_{xy}

decreases ceteris paribus as y increases. Output may remain constant if this

assumption is not made.

In both cases the supply price of labor to the modern sector is above the

subsistence wage.

Table 1 below summarizes the results for the various possible cases, which have been worked out on the assumption that the prevailing institutional framework is one of peasant proprietorship. It can easily be seen that the results are the same when the system of land tenure is one of share cropping or tenant farming since the transformation curves will have essentially the same shape and the point at which $MRT_{xy} = 0$ will coincide with the point at which $MP_L = 0$.

The general case, as we have seen, is one in which real agricultural output declines when workers move to the modern sector. If $MP_L = 0$ initially it will become positive as soon as some workers migrate. The real wage rate (in terms of wage goods) at which workers will migrate is initially less than or equal to the subsistence agricultural wage rate (W_S) when $MP_L = 0$ and will rise.

The preceding conclusion is inconsistent with the typical assumption made in the "labor-surplus economy" literature of a labor supply curve facing the modern sector which is constant in terms of wage goods up to the point where the marginal product of labor in agriculture is equal to the subsistence "institutionally determined" wage rate in the agricultural sector. This conventional view of the labor supply curve can be derived under the static conditions which are usually assumed only if one assumes leisure satiation (that the marginal utility of leisure is zero and that workers are willing to forego additional leisure for zero return) or that there is increasing marginal utility for "food." Of course, other factors not usually included in the static assumptions such as tax policies, changes in tastes, new products, or technical change in agriculture can produce a horizontal supply curve.

The Case of Wage Labor

Up to now we have considered the effect of labor migration from agriculture

Table 1

Characteristics of the Aggregate Supply Curve of Labor to the Modern Sector

Case	Initial Conditions	Effect on Output of Labor Withdrawal	Y-Intercept	Slope
Case I	$MP_L = 0$: income at subsistence			
i)	$MRS_{xy} > W_s$	decreases	$= W_s$	> 0
ii) (a)	$0 < MRS_{xy} < W_s$ or $MRS_{xy} = 0$ at and only at point of equilibrium and $\dfrac{MRS_{xy}}{y} < 0$	decreases	$< W_s$	> 0
ii) (b)	same as ii (a) except that $\dfrac{MRS_{xy}}{y} > 0$	constant or decreases	$< W_s$	$= 0$
iii)	$MRS_{xy} = MRT_{xy} = 0$ for infinite number of X	constant	$< W_s$	$= 0$
Case II	$MP_L = 0$: income above subsistence	decreases	$< W_s$	> 0
Case III	$MP_L > 0$: at subsistence level of income			
i)	$(MRS_{xy} > MRT_{xy})$	decreases	$> W_s$	> 0
ii)	income above subsistence level $(MRS_{xy} = MRT_{xy})$	decreases	$> W_s$	> 0

when the prevailing institutional framework was one of peasant proprietorship,

share cropping or tenant farming. These institutional forms all have the com-

mon characteristic that once the agricultural worker has produced enough food

to permit him to survive he can choose how much additional labor time he shall

spend on his land. When the $MP_L > 0$ the worker has the choice of taking out

his extra income in the form of food or additional leisure. Most important

however, is the fact that the marginal rate of transformation of work into

"food" diminishes as the quantity of work increases.

Another institutional framework which is widely prevalent in developing

economies is that of wage labor. It is often assumed that institutional con-

straints are such that the wage rate paid to wage labor is above its marginal

product[1] and that the employer is not free to fire workers at will. If an em-

ployer hires a wage laborer he must pay a subsistence income regardless of the

amount of work he gets in return. Within this constraint, the land owner would

maximize his own income by obtaining labor inputs from his employees up to the

point where their $MP_L = 0$.[2] Note that institutional constraints must deter-

mine both the number of workers he must hire as well as their income. (He is

under some obligation to keep everyone alive at the subsistence level.)

As workers leave for the modern sector, there is more land available for

the remaining wage laborers to work with. Land owners who maximize profits

within the constraint of the number of laborers they must hire would react by

forcing the wage laborer to work longer hours for the same subsistence income,

i.e., for a wage _rate_ which would be below the wage _rate_ which prevailed before

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[1]If labor is paid its marginal product then the withdrawal of labor from
agriculture will result in a decrease in total agricultural output. The sup-
ply curve of labor facing the modern sector will have an intercept equal to
the wage rate in agriculture (plus transfer costs) and will have a positive
slope.

[2]Whether this typically happens is, of course, an empirical question.

the migration of labor took place. The only definite constraint on this would be the physical capability of the worker. Until this constraint (or some institutional one) is reached, the effect of migration is to leave total agricultural output constant. When the constraint is reached, further migration will reduce total agricultural output.[1] If the agricultural sector is over-populated to the point where only a few hours work per day are required from each individual to produce the maximum total output possible, then the supply curve to the modern sector would be u shaped. In Figure 6 the dashed line, S_L is the supply curve. As the first people move from agriculture to industry, the landlord requires the remaining ones to work sufficiently longer hours to prevent a decrease of total output. This implies that the income per hour worked (implicit wage rate, designated by the curve W_sW_s') decreases as workers leave. When the remaining workers are unable to produce the maximum output (i.e., $MP_L > 0$) they continue to work the physically or institutionally determined maximum number of hours and to receive the same wage. During this phase implicit wage rate is constant until enough workers have migrated so that if the maximum possible number of hours is worked the marginal product of the last worker is greater than the subsistence wage. Beyond this point wages are determined by market forces.

The supply curve of labor to the modern sector is not determined solely by the implicit wage rate in agriculture, since there are constraints with respect to the number of hours which must be worked in agriculture and probably also in the modern sector, with the two usually not being the same. In Figure 6, we have assumed that there is a standard working day in the modern sector. As a result the supply price of the first units of labor is below the implicit wage in agriculture since in agriculture the workers are unable to work more than a few hours (due to labor redundancy). Being able to work more hours in

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[1]This point would correspond to the "shortage point" in the Fei-Ranis model.

industry and having sufficient leisure so that its marginal utility is not too high, they are willing to work for less per hour in the modern sector. As the redundant labor disappears in agriculture, a point is reached where the remaining workers are working the same number of hours per day as the standard in manufacturing; here the S_L curve and W_sW_s' cross (assuming no basic preference for living or working in the modern or in the agricultural sector). As labor becomes still more scarce in agriculture, but the marginal productivity of the last worker is still not equal to the institutional wage rate, S_L rises above W_sW_s', since the worker who goes to industry cannot work as many hours as if he stayed in agriculture, and must receive more per hour to just get a subsistence level of income.

At the point where the marginal productivity of a man working the physical or institutional maximum of hours is equal to the institutional daily wage (point A), market forces begin to play a role and the curve W_sW_s' ceases to have a clear interpretation. The S_L curve may begin to rise gradually at this point or it may shift discontinuously up and then rise gradually. The former result (shown as S_{LA}) occurs if, as the worker's condition improves, he prefers to increase only leisure at first. This preference pattern can occur given indifference curves which intersect the subsistence income line SS'. (It could also result if the income elasticity of demand for nonleisure goods is just equal to zero.) The more likely case would be one in which the supply curve sloped smoothly up from point A (shown as SL_B).

If labor is not redundant, the downward sloping portion of the supply curve will, of course, not exist and the intercept of the labor supply curve will be above the implicit wage rate in agriculture. When the downward sloping portion is present, the intercept can be below, equal to or above the implicit subsistence wage rate. Only when workers receive a salary above their

$ 00
goods

W_s

S_L

S_{L_a}

S_{L_b}

W_s

Implicit
wage rate
in agricul-
ture

A

$W_{s'}$

$MP_L=0$ $MP_4>0$ $MP_L^*=W_s$
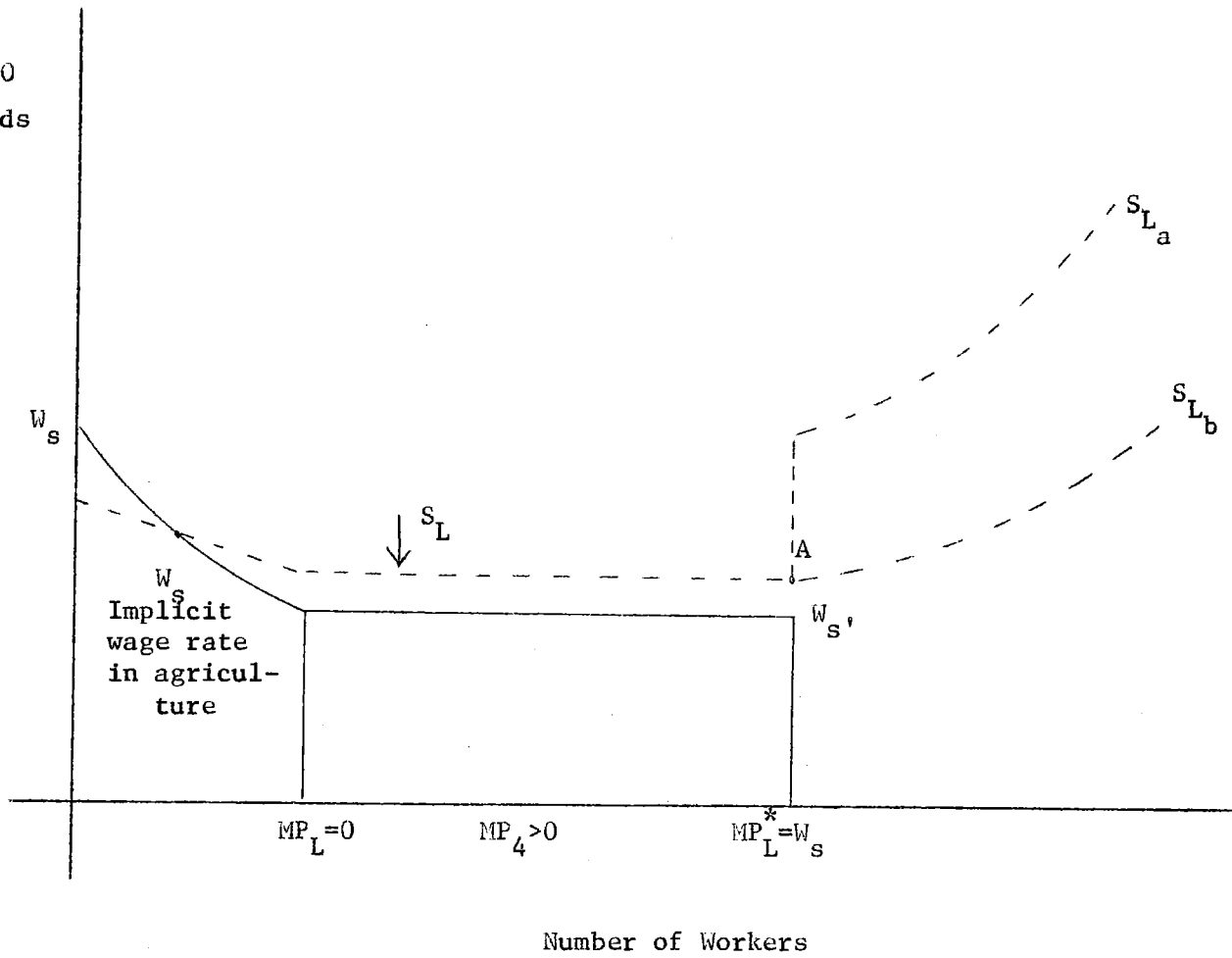
Number of Workers

Figure 6

marginal product will the horizontal section exist. When the wage is not above the marginal product, the supply curve is upward sloping.

Once labor is earning its marginal product in agriculture the employer can no longer dictate the length of hours worked by the agricultural worker. These would presumably be arranged by negotiation.

Table 2 summarizes the results for the case of wage labor. Here it can be seen that agricultural output may remain constant when labor moves to the modern sector so long as a) wage labor is being paid a wage rate above its marginal product and b) employers are able to force workers to work longer for the same income. Note, however, we do not get a horizontal supply curve for the modern sector even in this case, for agricultural workers will be willing to work in the modern sector at a wage rate (in terms of wage goods) equal to or even below the implicit wage rate prevailing in the agricultural sector, but one which rises as more workers leave agriculture.

Some Qualifications

The preceding analyses were made under the simplifying assumption that all land and other nonlabor inputs were distributed uniformly over the whole agricultural work force and that as each worker moved from the agricultural to the modern sector that resources were once again reallocated to ensure a uniform distribution. Under this simplifying assumption we could speak of a "representative" worker and analyze the conditions under which he could withdraw from the agricultural sector and move to the modern sector.

At any one point in time resources are not evenly distributed over the entire agricultural work force. In particular, one would expect to observe large differences in the land endowment per worker, particularly if a system of peasant proprietorship exists. Also, when labor moves out of agriculture,

Table 2

The Case of Wage Labor

Case	Initial Conditions	Effect on Output of Labor Withdrawal	Characteristics of the Aggregate Supply Curve to Labor to the Modern Sector	
			Y-Intercept	Slope
Case I				
i)	$MP_L = 0$; $W_s > MP_L$	constant	$= W_s$	< 0
ii)	$MRS_{xy} > W_s$	constant	$< W_s$	< 0
iii)	$0 < MRS_{xy} < W_s$ or $MRS_{xy} = 0$ at and only at point of equilibrium	constant	$< W_s$	< 0
	($MRS_{xy} = 0$ for infinite number of X (leisure satiation))	constant	$< W_s$	< 0
Case II	$W > MP_L > 0$			
i)	same as in Case I (i)	decreases	$= W_s$	$= 0$
ii)	same as in Case I (ii)	decreases	$< W_s$	$= 0$
iii)	same as in Case I (iii)	decreases	$< W_s$	$= 0$
Case III	$W = MP_L > 0$			
i)	same as in Case I (i)	decreases	$= W_s$	> 0
ii)	same as in Case I (ii)	decreases	$< W_s$	> 0
iii)	same as in Case I (iii)	decreases	$< W_s$	> 0

it is not likely that the resources which he was using will be uniformly dis-
tributed over those remaining workers. Markets are probably sufficiently im-
perfect so that family members who benefit when one of them moves to the city
would rather hold onto the additional land thereby released rather than acquire
any other asset (real or monetary).

How do these interpersonal differences in resource endowments affect our
results?

First, the existence of interpersonal differences in resource endowments
would mean that at any point in time, there will be differences in the MP_L
and AP_L for different plots of land.[1] As a result of differences in the
AP_L (and hence the implicit wage rate) the supply price of labor for differ-
ent workers will differ.

The importance of this qualification is that the aggregate supply curve
of labor to the modern sector(which is the horizontal summation of all of the
individual supply curves) will, in most cases, have a smaller intercept and a
greater positive slope than would be the case if all land were uniformly dis-
tributed over the entire agricultural work force.

Second, since land will not be reallocated over all remaining agricultural
workers when one migrates to the modern sector, migration will affect only some
of the remaining workers. In particular migration will not shift the trans-
formation curve of all remaining workers upwards and hence will not increase
the supply price of all remaining workers. Still, if we assume that workers
from each farm have similar indifference curves there will be a tendency for
more to leave from the farms with little land per man. The result will be a
tendency for this ratio to equalize on all farms and as such an equality is

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[1]The existence of and implications of such differences are dealt with
extensively by Mellor, op. cit.

approached. Events will parallel more and more those occurring under the earlier assumptions. When the man/land ratio differs greatly within agriculture, total output is below its potential and static misallocation loss in the economy is positive. As this ratio is equalized through the above process, the static misallocation loss decreases, so overall growth is faster than it would have been if the man/land ratio were uniform throughout agriculture.[1]

Summary and Conclusions

To date there has been considerable research and discussion concerning the magnitude of the marginal product of labor in agriculture. The issus is thought to be important because of its implications for the supply price of labor to the modern sector and for the terms of trade between the modern and agricultural sectors. In this paper we have shown that given the usual assumptions about consumer indifference curves these effects of labor migration to the modern sector are generally independent (at least in direction) of whether or not the marginal product of labor in agriculture is positive or zero. In both cases total agricultural output will decline when labor is moved to the modern sector. Also in both cases the supply price of labor will usually rise as more and more labor is withdrawn from the agricultural sector. The initial supply price of labor may be equal to or below the prevailing implicit wage rate in agriculture.

In order to derive the conclusions of the Fei-Ranis model one must assume either a) that there is leisure satiation in the agricultural sector

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[1]In fact such an equalization process does not often seem to occur by free play of the market; there are important dynamic forces working in the opposite direction , as for example, when better off farmers educate more of their children and these migrate to the city while poorer farmers with less land do not put their children through school so that their farms are split up even further in the next generation as these children do not migrate. But we are abstracting here from such phenomenon.

or b) that there is increasing marginal utility of "food" as the quantity of "food" consumed increases.

If the institutional framework prevailing in agriculture is one of wage labor, it is possible for the conventional shapes of indifference curves to have total agricultural output remain constant when labor migrates to the modern sector if the implicit wage rate prevailing in agriculture is above the marginal product of labor and in addition if agricultural laborers are working less than the physical or institutional maximum. It is also possible to have a range in which the supply price of labor to the modern sector in terms of wage goods is constant. But the latter result occurs when MP_L > 0 so agricultural output declines when labor is transferred to the modern sector. With conventional indifference curves it is not possible even for the case of wage labor to get simultaneously both constant agricultural output and a constant supply price of labor to the modern sector in terms of wage goods.

Hence, we may conclude that the fact that the marginal product of labor time in agriculture is equal to or greater than zero is not the dominant factor determining what happens to total agricultural output and to the supply price of labor to the modern sector when labor is withdrawn from agriculture and transferred to the modern sector. The magnitude of the marginal product of labor in agriculture can be given a dominant role only if the indifference curves of consumers in the agricultural sector are of a particular shape or if one introduces other variables into the analysis, for example, an active taxation policy on the part of government which acts in such a way that agricultural workers always kept at the subsistence level of income and at a point where the marginal product of labor is equal to zero.