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PLANNED PRODUCTIVITY GROWTH AND WELFARE

by

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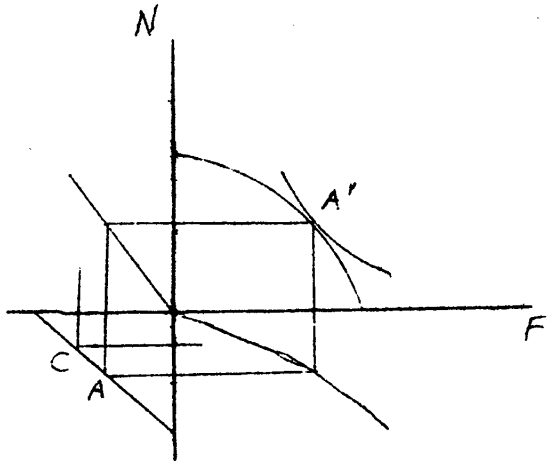
E R R A T A

p. 2 **Line 13:** data <u>are</u> available.

p. 6 **Line 12:** adds up to <u>are</u> permissable.

p. 16 **Figure 2**
One set of reference lines and three point designators are omitted. The "box" and points A', A and C.



p. 17 Fifth line from the bottom: B should read C.

Fourth line from the bottom: omit small c after B'.

p. 18 Seventh line should read: A to C (not A to B).

PLANNED PRODUCTIVITY GROWTH AND WELFARE

D.A. Worcester, Jr.

Planned growth is a major objective of many economic societies today. The majority of these are undeveloped in the sense that great strides can be made by applying the technology already well-developed elsewhere. The introduction of a more productive socio-economic system requires reallocation of resources among and within the principal sectors of the economies. Attention is often centered on increasing the accumulation of capital goods by increasing the proportion of income saved and by increasing the quantity and quality of labor input by means of planning. But planning is a form of entrepreneurial activity. Hence the introduction of deliberate planning to enhance productivity growth implies that the decisive requirement for growth is the reallocation, reorientation and augmentation of *entrepreneurial* resources. It is odd that planners, who have an obvious interest in manipulating the economic life of a nation or region should not have viewed themselves as superior entrepreneurs and taken the success (or failure) of their plans as pay offs for their talents as such. The principal differences between the classical entrepreneur and the planner is the latter's failure to be prime risk-takers and to manage directly, but in these they do not differ greatly from the captains of many modern corporation.

Redirected entrepreneurial activity can augment growth by making a wise choice among available techniques, a wiser allocation of capital, inducing a wiser allocation of labor, and by acting as more perfect maximizers over time especially with respect to the needs of complementary sectors.

Leibenstein has argued that the reallocation of resources towards improved management yields outstandingly high returns as compared to reallocation of labor and capital.[1] He surveys the literature and finds the rates of return to be something like 1/10 of one per cent for reallocation of labor and capital but something between 9% and several hundreds of per cent for "X-efficiency" as measured in specific firms and industries for which entrepreneurial data for available. Leibenstein argues that this result is possible because actual performance is often well within the productivity frontier appropriate to readily accessible managerial procedures. Large productivity gains await only entrepreneurial energy to move performance to that frontier.

This view too easily assumes that tight organization

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[1] Harvey Leibenstein, "Allocative Efficiency vs. 'X-Efficiency'", *American Economic Review*, LVI; 392-415, June, 1966, No. 3.

and hardworking employees can be obtained at nominal cost. It is preferable to ascribe high rates of return to improved or augmented entrepreneurial activity. Otherwise, one must wonder why so little response was elicited in the recent past by opportunities said to be so magnificent. But the opportunities may be real enough, awaiting organization with a wider vision.

At least three hypotheses may be advanced to account for the greater success of augmented entrepreneurship over additional supplies of capital and labor:

1) a greater quantity of entrepreneurial talent may be obtained either at the expense of leisure or by recruiting entrepreneurs from other occupational groups with low productivity,

2) the quality of the decision-makers may be sharply improved by educational programs, pressures from visiting productivity teams and from representatives of credit institutions,

3) system changes, externalities beyond the capability of individual entrepreneurs, can be introduced which will so alter the rewards and penalities in some sector as to induce activity that is more production and innovation-oriented than before. Since entrepreneurial success depends upon performance

relative to one's rivals, a process once established in some sector can have far-reaching and long-lasting effects. Two or all three of these may operate together.

The last two arguments suggest the probability that growth will be more rapid if scarce planning resources are concentrated in a limited number of areas. Self-sustaining growth is more probable if the effected decision-makers must compete with each other for skilled personnel, equipment, markets and the like in order to hold their gains. It follows that growth may be faster if it is concentrated in fewer sectors rather than spread uniformly across the economy. In less developed regions balanced growth tends to spread management talent thinly, placing it in competition with an unresponsive traditional sector which can stifle rather than stimulate cumulative growth.

If this is true, the shape of the growth possibility curve which reflects improved entrepreneurial efficiency will differ markedly from the usual production possibility curve. The difference is analyzed below.

I. Nature of the Growth Frontier

When growth is conceived in terms of additional quan-

tities of inputs, or quantity equivalents where inputs are more productive because the inputs themselves embody more knowledge or investment, it is natural to view growth as a proportional expansion of the production possibility frontier. Different conclusions follow when growth is seen as the effect of pressures upon a relatively small group of decision-makers to seek, install and manage superior productive process. Something like scale economies may exist to entrepreneurship in *each* of the various sectors taken separately that do not exist in the economy as a whole. Where this is the case, unbalanced growth may be preferred to balanced growth.

Attention is focused in the following pages upon the probable desirability of unbalanced growth. A highly simplified model is used so as to encompass the welfare, cost, explicit production functions for each product, and the supply of factors in a single set of fully related diagrams.

The simplifying assumptions follow. Knowledge of superior productive processes is postulated to be available at no cost to the developing nations. All variable costs are reduced to labor costs, and the supply of man hours is taken as fixed. Full mobility of capital and labor is assumed.

This implies that less time is required for factor mobility than is required to reorganize management within and among the sectors. The resources of the planning agencies are limited. For analytical convenience we further assume that the economy is divided into only two sectors "food" and "non-food".

To isolate the effects of scale-like economies it is assumed that management improvements, over some period of time, can double the productivity per unit of "labor" in either sector, but will increase in each sector by only 50% if divided evenly between the two sectors. Alternative divisions of effort in any proportion that adds up to one permissable.

Analysis is also simplified by assuming that there are at most two factors other than labor and planner's entrepreneurship; one input specific to each of the two industries. The specific factors include normal management, whose enhanced skills rest in part upon intimate knowledge of their own sector. Enlarged productivity is revealed as a larger output per unit of labor.

New production techniques resulting from differing levels of entrepreneurial activity effect the height but not

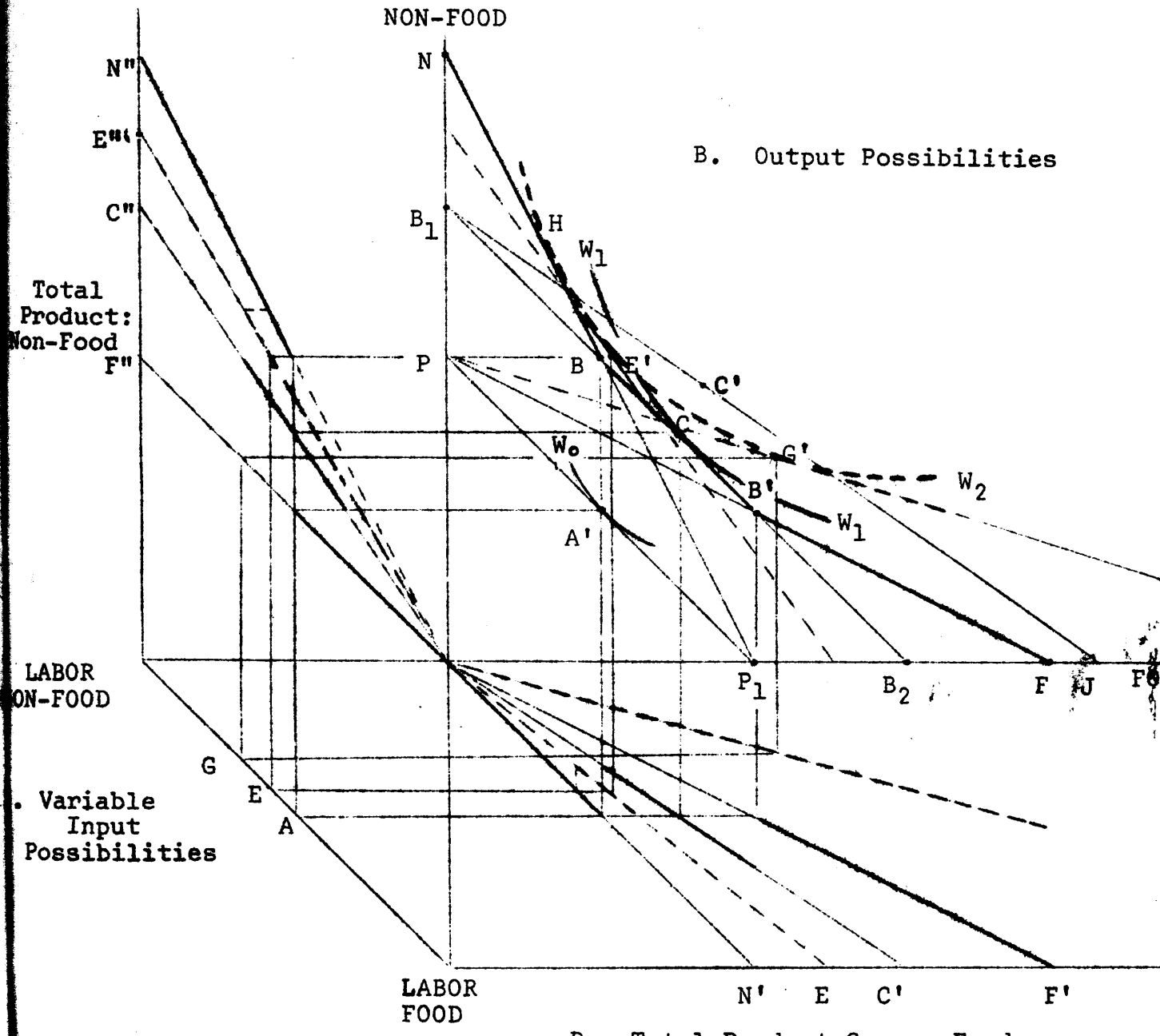
the shape of the production functions for the two goods. Only two types of production functions are considered: constant returns per unit of labor, and diminishing returns per unit of labor. The first is appropriate when the specific factor is in redundant supply, the second when it is not.

Comparative statics is used to compare alternative points of general equilibrium in a closed economy, for various welfare functions.

Balanced vs. Unbalanced Growth: Case I, Constant Costs

For Case I, assume that the specific factors are in redundant supply in both industries so that the alternative production possibility curves are straight lines, as illustrated by the four diagonal straight lines in the Panel B of Figure I. Panel C shows every division of the fixed labor supply between the two industries. The Panel D depicts the relationship between alternative labor inputs and the total output of food. The Panel A traces the relationship between the quantity of labor input and the output of non-food. The Panel B connects outputs of food and non-food relevant to the corresponding division of the labor force.

Figure I


NON-FOOD
N
N"
E"
C"
B1
H
W1
Total Product: Non-Food
F"
P
B
E'
C'
C
G'
W2
Wo
B'
W1
A'
B. Output Possibilities
LABOR NON-FOOD
P1
B2
F
J
G
E
A
. Variable Input Possibilities
LABOR FOOD
N'
E
C'
F'
D. Total Product Curve: Food

In the base period the alternative outputs are shown by the solid line in the PP' in the northeast panel (B), but we assume that labor is deployed in equal amounts to the two industries, as shown by point A' and by point A in the southwest panel (C). Three "growth possibility curves" as shown, NBP_1 and PB'F where the imported technology alternatively doubles output per man-year in non-food production or in food production, and B_1BB_2, where output per man hour is raised by 50% in both industries.[1] Thus, the same quantity of labor, divided in the same manner, as shown by point A, yields the alternative outputs shown by point B, C, or B', depending upon which of the growth possibility curves is chosen by the planners or evolved by the market forces.

If all possible divisions of development efforts were drawn in, an infinite number of "growth possibility curves" would outline an envelope which would touch the growth possibility curves shown at points N, C and F. We shall refer to such an envelope as the "growth frontier" but will confine our attention to choices among a limited number of alternatives that only approximate the smooth limiting function. Such a

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[1]Although it is not obvious, increasing returns to entrepreneurship are implied whether entrepreneurial effort is concentrated in one sector or in the other for concentration carries the possibility of doubling the physical pro-

curve is fundamentally convex to origin, and would remain so even if the production possibility curves were moderately concave to the origin rather than the straight lines shown here. The effect of diminishing returns upon the shape of the growth frontier is considered in more detail below. For the moment, it is enough to note its existence, and its general shape.

Welfare Conditions for Optimal Growth

The optimal point on the growth frontier is attainable by choosing the optimal growth possibility curve. This is found when either a point of tangency between an appropriately defined social welfare function and the growth frontier is located, or when the highest social welfare function is found at a corner along one of the axes. The latter condition, often rashly ruled out, is especially important in this case since both the welfare function and the growth frontier tend to be convex to the origin. The growth frontier may in this case also coincide with the welfare function for part of all of its length. In that case there is no unique optimal choice.

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ductivity of the whole labor force, while balanced development raises it by only 50% in each sector.

Henceforth, we confine our attention to welfare functions which are more convex than the growth frontier. We do this because coincidence of the two is a very special case, and complete specialization is untypical of even rather small-sized planning units.

Consider first a welfare function constructed so that the marginal rates of substitution in consumption are homogeneous of degree one and display smoothly declining marginal rates of substitution along each indifference curve. Thus as real income rises, the optimal proportions remain the same if, but only if, the marginal rates of substitution in production also remain the same. The equilibrium welfare functions meeting these conditions are shown as W_0 and W_1 in Panel B of Figure I.

Given our assumptions with regard to production, optimal growth requires proportional expansion to point C, balanced growth, in each industry under these circumstances. Note that this choice does not maximize an index of production that uses base year weights. That would happen only with complete specialization in one sector or in the other. But other weighting systems favor point C despite the fact

that average labor productivity in real terms is not maximized. If the assumption of a closed economy is dropped, however, the case for specialization must be enhanced.

It is also of interest to note the range of choices open to planners interested in a particular output result. Any combination between B and B' can be produced with no reallocation of labor between sectors by dividing the managerial improvement between the two sectors in the appropriate way as shown by the lines from point A (Panel C) through the individual product diagrams (Panels A and D) on to points B, C and B' in Panel B. If only three plans are possible, however, the successive combinations from N to F shown on the growth frontier require varying input combinations with the movement sometimes into and sometimes out of food production, with the division shown at point A occurring three times, and each of the remaining divisions twice. This is shown by the relevant sections of the individual production functions (shown by the heavier lines).

If the planners could consider an infinite number of possibilities the smooth envelope curve touching the present function at points N, C and F would be relevant. One point,

E', which is virtually on the envelope is shown along with the appropriate productivity functions illustrated by dotted lines in Panels A and B. It is evident that this requires a shift of labor *toward* the sector enjoying the larger increase in output per man as shown by a comparison of points A with E in Panel C. Thus, if the income elasticity of food were enough less than 1.0, and that of non-food enough more than 1.0, to make point E' the welfare optimum, the optimum plan (among these four) is to put 3/4th of the productivity effort into non-food production and shift about 7.5% of the labor force from food to non-food production.

Historically, increases in real income have been accompanied by a relative decline in the output of food while output per man hour rose dramatically in the production of both food and non-food. Thus reality is better approximated if the welfare function reflects a less than proportional rise in food consumption as increases in real income occur while non-food consumption rises more than proportionally. This is shown if the broken line, W_2 is associated with W_0. The expansion path runs through points A' and E', rather than the balanced path A'C.

It is easy to draw a curve such as W_2 to yield the

same level of welfare with all productivity increase placed on non-food, as shown by point H. The reader can verify that this requires a shift of labor from food to non-food production.

The desirability of expanding the more interest elastic good depends upon the postulate that manpower productivity can be increased proportionately in either sector. If greater productivity gains can be made in the food sector some function like that shown by the broken productivity lines in Panels B and D becomes relevant and a possible equilibrium output is found at point G with the full productivity increase lavished on food production. Because of the income elasticities, however, a considerable transfer of labor out of agriculture is necessary if that optimum is to be attained, as shown by point G in Panel C. But a superior alternative exists because a 50-50 division of entrepreneurial activity produces the production possibility curve B_1J. Some equilibrium point like C' on a higher indifference function is possible. Moreover, it requires a lesser shift of resources.

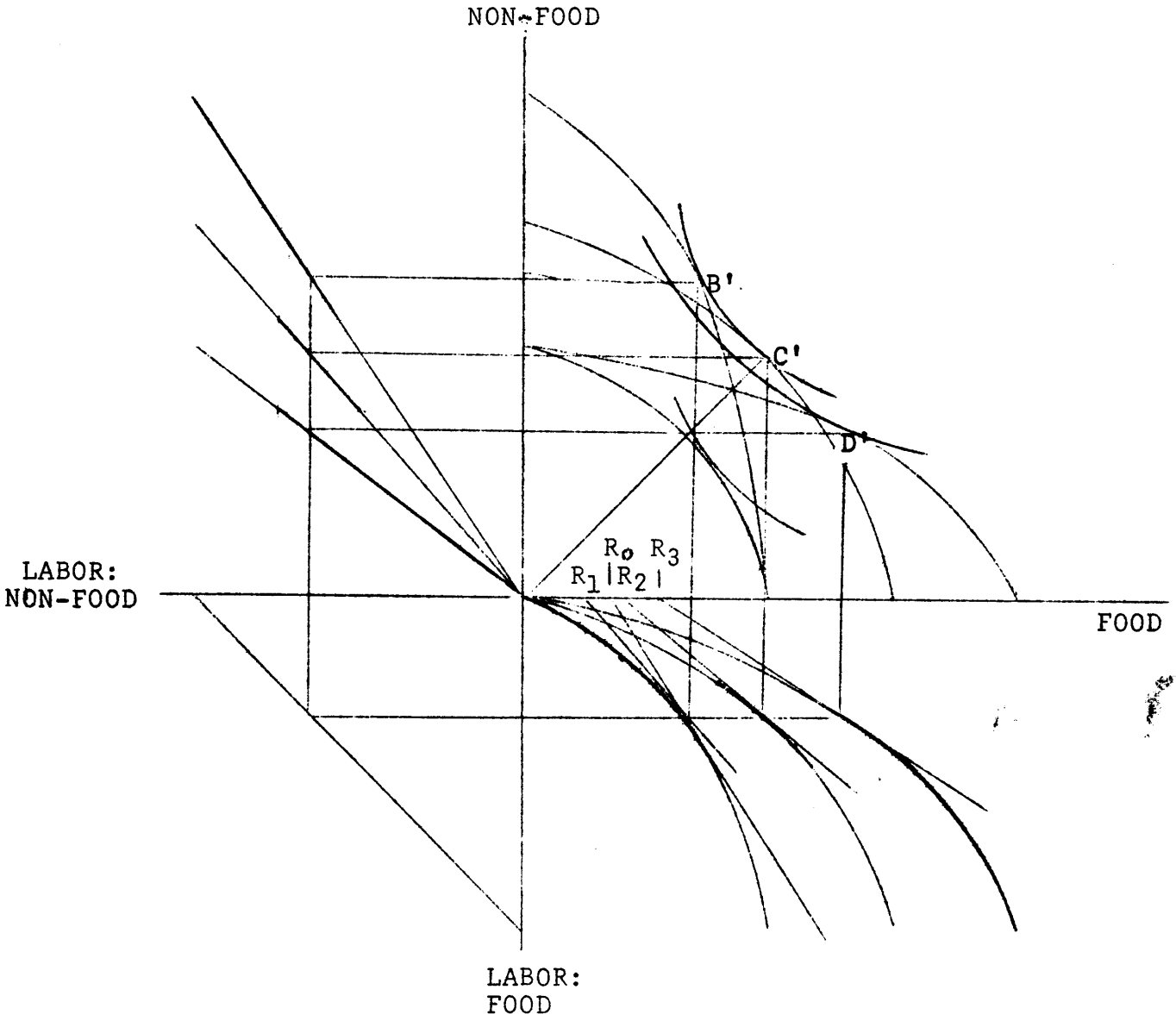
Rising Supply Price

No fundamental change in the analysis of resource allocation is necessary if diminishing returns is substituted for constant returns, but some effects on functional income distribution appear which are of interest. This becomes important when there are some necessary inputs either specific to one sector, or better suited to one sector rather than another. When either or both of these conditions exist factor prices change with shifts of production and some part of some factor's incomes are rents. This may be aggregated if the factor proportions differ in the two sectors.

For purposes of illustration, constant costs are assumed to be appropriate for the non-food sector, but rising costs due to Ricardian rents is assumed to exist in the food sector. This is illustrated in Figure 2.

The growth frontier is bimodal at positive outputs of both products (rather than at the axes). It remains generally convex to origin in this illustration, although it would become concave if costs rose fast enough. A given social welfare function will, therefore, depart more rapidly

Figure 2



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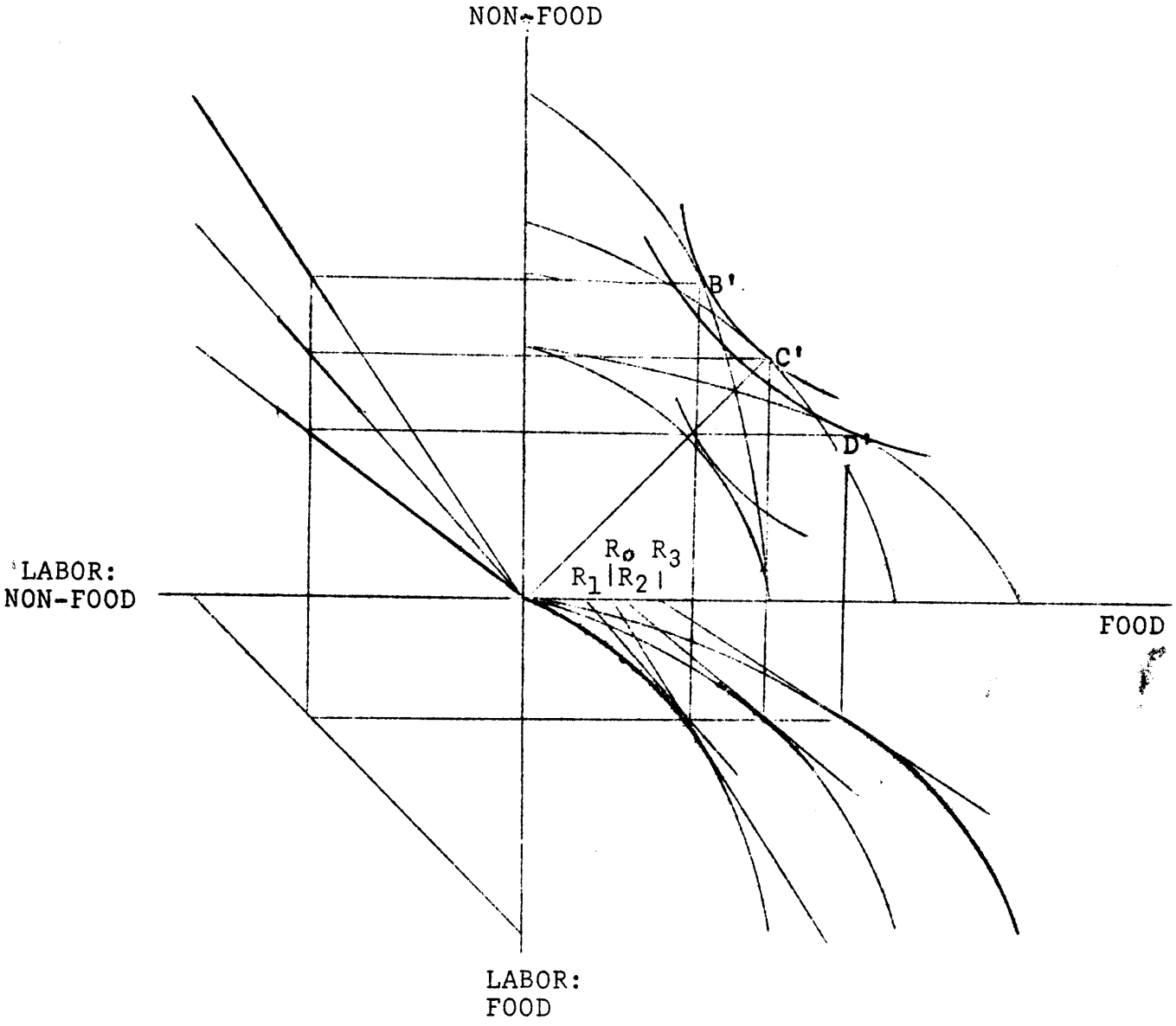

from the growth frontier as one moves away from points of tangency. Nevertheless two, even three points of tangency may exist even with a smooth welfare function.

In Figure 2 the preferred increase of food production is again shown to be less than proportional, and of non-food to be more than proportional to the growth of aggregate production at constant relative prices. The optimal response to a concentration of productivity increase in food production is shown (at point D') to lie on a lower indifference curve, while a 50-50 division or a 0-100 division of productivity increase which favors non-food production are shown (at points C' and B', respectively) to produce equally satisfactory results.

A transfer of resources is indicated from food to non-food regardless of what division the productive increase takes. An identical shift of manpower, from point A to point B on the labor input diagram (Panel C) is associated with the proximate optima B'c, C' and D'.

Distribution of Income Between Rents and Labor

Because the specific factors in the food sector are economically scarce technical progress will except in very

special cases change the proportion that rents bear to total incomes. This is illustrated in Figure 2.

It will be recalled that the real labor input in the two industries taken together is held constant. In the case illustrated, a shift of labor to non-food production follows the adoption of any of the growth possibility curves. The labor transfer is shown by the movement from A to D in southwest Panel C. Because the specific factor necessary in the non-food industry is redundant, its marginal productivity curve of labor is horizontal. But diminishing returns to labor are found in the food industry. The slope of the total product function at the equilibrium output reveals the optimal marginal product of labor in food production, and since there is no discrimination in the labor market, this marginal product must be equivalent in welfare terms to the marginal product in the non-food industry at equilibrium points.

The difference between the sum of the marginal products and the total product may be considered to be the rent of the specific factors, in Figure 2 this is OR_0 before growth. Choice of the growth possibility curve has a strong effect on rents. If productivity increases are concentrated on non-food industries rents will fall by one-third to OR_1. But

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if progress is concentrated in agriculture, rents double (to OR_3).

This may seem to be a paradoxical conclusion, for the smaller is agriculture in the total economy, the higher the relative price of agriculture products, yet the lower the aggregate rent. Likewise, the more agricultural productivity is raised, the lower agriculture prices become, the larger are agricultural rents -- in this case total rent -- in the factor payments. This relationship, although paradoxical, it is not perverse, because it simply reflects the relative scarcity of the specific factor. With the same land and less labor, relative rents fall. But if agricultural productivity rises, both wages and rents rise in absolute terms. Unless the productivity increases operate primarily to increase the productivity of land itself, thereby making it more abundant, rent rises as a proportion of national income if prime emphasis is placed on agricultural development.

Where the specific factor is scarce in both industries, the effect of productivity increases on rents depends upon the exact nature of the production functions and the shift in the relative outputs of the goods required to reach the new

optimum. If the production functions of the two goods are bowed but identical, the increase in rents is proportional to the increase in productivity regardless of the division of the productivity gain between the two industries. Nevertheless, a specific distribution of income is implied by each optimal point on the production function. Changes in the rent/wage ratio may be an important criteria in the determination of optimal monetary and fiscal policies, as well as wage price policies, by central authorities.