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VENT FOR SURPLUS GROWTH IN A COLONIAL ECONOMY: A TENTATIVE MODEL

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Despite his insight into an important phase of the development of less developed countries, Hla Myint's discussion of vent for surplus export growth has received little formal attention in the literature.[1] In part this may be because growth of this nature might be considered as a special case of the reallocation of resources within the context of neoclassical theory.[2] This view neglects, however, the essential insight that the reallocation of resources within an economy at a very early stage of development is severely constrained by the high transactions costs and risks associated with large scale internal commercial exchange, but that reallocation may occur very swiftly, under certain conditions, when these costs and risks are reduced with the opening of the economy to foreign trade.

Historically, rapid resource reallocation in the direction of external trade has occurred under two sets of circumstances. In some instances, producers and colonial governments acquired direct control of land and natural resources and a substantial measure of indirect control over unskilled labor. These factors were then combined with imported skills and capital in mining and plantation enterprises. Under other circumstances, resources were reallocated within the family or village structure, thus necessitating a minimum of interference with traditional social values and institutions. . . . Where local labor was inadequate to fully exploit available opportunities, some form of markets in land and labor frequently developed to allow immigrants to supplement the efforts of the indigenous people,

usually without requiring vast immediate changes in the nature of traditional society.[3] It is this second setting with which we are concerned.

In the next section of the paper some of Myint's ideas related to vent for surplus growth and their interpretation by Findlay are set forth and commented upon. Attention is focused, too, on Myint's concern for the effects of population growth, unleashed by the same sets of factors stimulating the expansion of exports, but with a longer delay. In the following two sections a formal model is presented within the framework of which are examined the assumptions of Myint and some various stages of development of an agricultural economy expriencing this type of growth. The model is only tentative in that growth is assumed to occur within a particular type of colonial economy, the objectives and parameters of which are rather arbitrary.[4] Nevertheless, many of the conclusions are quite general and can be applied to a variety of historical experiences. The last part of the paper presents some conclusions and implications for policy.

II. Myint's "Vent for Surplus" Theory of Growth

In applying the 'vent for surplus' notion of Adam Smith to the experience of South-East Asia and Africa during colonial rule, Hla Myint distinguishes three separate sources of labor's contribution to

export growth. First, there is a reallocation of labor from subsistance agriculture, with its relatively low productivity, to the more productive mining and plantation sectors. This is seen as a once-and-for-all phenomenon, however, since the cheap labor policies employed by colonial governments discouraged capital deepening and technological improvement. Second, increased productivity can occur as the result of specialization and the acquisition of skills. In mining and plantation agriculture this was ruled out because low wages encouraged high turnover rates, which inhibited skill formation. The other major export sector, peasant cash crop farming, was also not suitable for the continuous improvement of skills since output was either of the traditional food crops such as rice, which required no modification of technique, or, if it was of a new crop such as cocoa, methods of production were apt to be fairly similar to traditional techniques and easily learned.

It is the third source of labor, and land as well, which most interests Myint. He assumes that prior to the opening of trade these resources are in surplus, having few alternative uses. With respect to land, the assumption is one of low population density in the area of potential export production. As for labor, after subsistence food requirements are met, there are still a substantial number of manhours remaining without productive use. These surplus hours are not absorbed into other forms of domestic production because

of the lack of effective demand owing to the poor internal transport system and absence of well developed markets.

Although Myint does not clearly establish the relationship between low population density and surplus labor, such a relationship probably exists. As a number of writers have pointed out, subsistence food requirements in sparsely populated areas are usually met using land extensive agricultural techniques.[5] Individual homesteads or villages are separated from each other by long distances since farmers have an incentive to surround themselves with land sufficient for long periods of fallow. Restoration of the soil after each period of cultivation is accomplished naturally without appreciable labor input, and the farmer has a large amount of time for leisure or non-agricultural productive activities. The long distances separating farmers, however, result in high costs in terms of time or resources of transporting goods or services between them. As a consequence, each homestead or village tends to be self-sufficient, and there is little incentive to specialize in production and increase consumption via domestic trade.
Given the absence of an exchange of goods and services outside the self-contained community, moreover, methods of transportation are likely to be relatively simple, head porterage frequently being the principle means of carrying goods. The lack of development of a more efficient means of transporting more goods longer distances contributes, in turn, to the absence of internal trade.

Ronald Findlay has argued that part of the labor time not employed in producing food may be engaged in handicraft production for domestic use and thus may not actually be surplus in the sense of having no useful alternatives.[6] Myint acknowledges this but argues that the rapid rates of export expansion experienced by these economies imply that not all of the increases in labor input could have resulted from a reallocation away from handicraft production, though he presents no empirical evidence to support this claim. To explain the existence of surplus labor time, Findlay asserts that the very low productivity of labor in the handicraft sector relative to that in food production implies such a high cost of handicrafts in terms of food that the exchange of the latter for the former is limited. Since the food needs of the community are already satiated, any additional hours are taken out in the form of leisure. In other words, it is the combination of the low marginal utility of additional food consumption, the low labor productivity of local handicraft production, and the absence of opportunities for long distance trade which implies a very low opportunity cost of leisure.

The situation is radically altered by contact with a foreign economy in which market exchange is highly developed. Farmers who have been unspecialized in subsistence food production and who have available surplus manhours and access to surplus land may rapidly expand the production of cash crops to be exchanged for imported goods.

In addition to forgone leisure, additional labor time is obtained by contracting the production of handicrafts and by partially substituting imports for them in consumption.[7] The transition is facilitated, according to Myint, by the fact that farmers can continue to grow food for their subsistence needs and thus are less subject to the risks of world market conditions than if they specialized in production for export. Eventually, after experience with foreign trade has been gained, specialization in cash crops may become complete, but this unlikely to occur in the early years.

The crucial factor, historically, in opening these regions to trade was the role of Western governments, generally as colonial powers. They established law and order in areas which had formerly seen considerable internal disruption of trade and provided the basic transportation and communications infrastructure. They also frequently played an important part in agricultural research, in the introduction of new crops, and in the discovery of mineral resources. Given the initiative taken by government, which substantially lowered the risks of production and trade, private foreign enterprise could be counted on to bring in the necessary technology, capital, skills, and incentive goods which might be absent locally. Although colonial governments were not always established primarily for economic reasons,[8] it is clear that once in place they had a strong vested interest in encouraging trade, if for no other reason than to increase the main source of their tax revenues.

It is clear, too, that not all areas of the world were opened up at the same time, even among those regions colonized approximately at the same time at the end of the nineteenth century. Within the French empire, for example, territories differed enormously in their stage of development at the time of independence. One of the objects of the next section of this paper is to explain part of this variation.

Aside from stimulating exports, the action of colonial governments had another enormously important effect: increasing the rate of growth of population. In part this was accomplished by encouraging immigration, especially for work in European-owned plantations and mines. Of greater long run importance, however, was the decrease of mortality. This was accomplished by reducing or eliminating local warfare and famine as a result of the establishment of law and order and a transportation network, by preventative public health measures, and by the spread of individual medical attention.[9] The effect of this population increase was to cause sparsely populated areas to fill up until eventually land was no longer in surplus.

The reaction of peasant farmers to the increase in population density is of great interest. In some cases, such as Java, subsistence food production was maintained by continually increasing labor intensive techniques, while production for

sale was decreased--a process which Clifford Geertz has termed "agricultural involution."[10] Elsewhere, in Burma for example, farmers have moved toward complete specialization in exports but have not yet evolved new forms of technology and organization necessary to achieve sustained increases in income in the face of mounting population pressure.[11] Finally, a number of areas, such as some of the islands in the West Indies, have managed to achieve growth in the agricultural export sector as well as in other areas of their economies despite continued population growth.[12]

At this point, Myint argues, the vent for surplus theory, which predicts a decline in exports "as the domestic requirement of resources to feed a larger population increases," is superior to the factor endowments theory of trade, which predicts that the region will produce relatively more of its labor intensive good as population expands.[13] Assuming, with Findley, that food and the exported crop are the same, the latter theory implies that labor should shift out of the relatively land intensive agricultural sector into a more labor intensive manufacturing sector, exporting manufactures and importing food. If it does not, this may be because of imperfect markets, inflexible technologies, or incorrect policies, but, Findlay argues, the explanation is not contained within the vent for surplus theory of growth.[14] One can agree with this but at the same time ask whether a more thorough examination of the evolution of growth of the vent for surplus variety might not reveal some of the economic forces at work and how they affect the crucial transitional stage.

To do this, however, it is necessary to specify the model more precisely. One problem associated with the idea of the exhaustion of land surplus is that all land is never actually brought into cultivation, but farmers are instead forced to use progressively poorer land. Yet the disadvantages of using much of this land may be offset by increasing the use of labor in terracing, irrigation, manure-spreading, and other activities. Furthermore, all land is not equally accessible to world markets. In general, it is to be expected that the more remote and poorer land will be brought into production only at the end of the vent for surplus period of expansion.

Another problem is associated with the dual nature of land both as an input to agriculture and as a spacial barrier which can be overcome only at a cost in terms of transportation and communications inputs. Some of the same problems which discourage the development of internal trade in a sparsely populated region, for example, also inhibit the expansion of foreign trade. Government infrastructure and services such as education, health, and agricultural extension are all more costly per capita in areas of low population density. The same applies to private transportation services and to the costs of migration. If, at the critical moment when surplus land is exhausted, agriculture can evolve in the direction of greater commercialization and improved methods of production, there are substantial gains to be captured. If, on the other hand, agricultural involution ensues, market exchange will be reduced and the advantages of higher population density will be lost, though the disadvantages in terms of land scarcity may be expected to intensify.

III. A Tentative Model

It is assumed that the areas to be opened to trade within a newly established colonial empire may be divided into n regions, each homogeneous with respect to population density and of a size sufficiently small that the same ratio of export to import prices $\underline{P}$, after deduction for transportation costs to and from the world or mother country's market, applies to all farmers within the region. Each farm family is assumed to be of identical size and to have identical utility and production functions, constraints on its time, access to land of varying quality, and subsistence needs. The labor input of each farm consists of ℓ_1, the time spent working on agricultural land $\underline{a}$ of homogeneous quality, and ℓ_2, the time spent improving poorer land to bring it up to standard quality.[15] The first derivative of $\underline{a}$ with respect to ℓ_2 is assumed to be positive and the second derivative negative, indicating diminishing returns at the extensive margin. Per capita leisure s is defined rather broadly to include all the time left over from a fixed number of hours y* after substracting ℓ_1 and ℓ_2. Utility u is a function of leisure and imported goods m, and it is assumed that u_m, u_s, $u_{ms} > 0$ and u_{ss}, $u_{mm} < 0$, where subscripts denote first-and second-order partial derivatives. Similarly, the production function $x(\ell_1, a(\ell_2))$ is defined so that x_{ℓ_1}, x_a, $x_{\ell_1 a} > 0$ and $x_{\ell_1 \ell_1}$, $x_{aa} < 0$. Finally it is assumed that only that part of per capita agricultural output x which is in excess of subsistence requirements y* is exported.[17]

Assuming that utility is maximized and forming the Lagrangean expression

$$u(m, y^* - \ell_1 - \ell_2) - \lambda (m - P(x(\ell_1, a(\ell_2)) - x^*)),$$

the partial derivatives with respect to ℓ_1, ℓ_2, and m may be set equal to zero to obtain the following first-order conditions:

(1) $$-u_s + \lambda P x_{\ell_1} = 0$$

(2) $$-u_s + \lambda P x_a \frac{da}{d\ell_2} = 0$$

(3) $$u_m - \lambda = 0$$

(4) $$P(x(\ell_1, a(\ell_2)) - x^*) - m = 0.$$

These equations may be combined to yield the first-order equilibrium conditions

(5) $$x_{\ell_1} = x_a \frac{da}{d\ell_2}$$

(6) $$x_{\ell_1} = \frac{u_s}{u_m} \frac{1}{P}.$$

The marginal product of labor time at the intensive margin equals its marginal product at the extensive margin, and these are each

equal to the marginal rate of substitution in consumption between leisure time and the value of imports measured in terms of exports.

These conditions are shown together diagrammatically in Figure 1. Total available time y* is measured by BE along the horizontal axis, made up of BC units of S, CD units of ℓ_2, and DE units of ℓ_1. On the vertical axis in the lower part of the diagram is shown $\underline{a}$ as a function of ℓ_2, where ℓ_2 is measured to the right from point C. This curve CF is the opportunity locus for converting labor into land of constant quality. Given the total time committed to work CE, equilibrium is established at the point where this locus is tangent to an isoquant of the production function, satisfying equation (5).

In order for this to be full equilibrium, however, equation (6) must also be satisfied, as shown in the upper part of Figure I. Given leisure time BC, the level of output determined in the lower part of the figure multiplied by P is denoted by BG and determines the point H. Other amounts of leisure and output satisfying equation (5) will generate the curve EJ. The point of tangency of this curve and an indifference curve satisfies equation (6), as long as $Px \geq Px^*$.

To simplify the analysis at this point it is useful to assume a fixed relation between land of standard quality and output. Let ℓ_2 be defined so that it includes the labor necessary to produce this output per unit of land as well as the labor required to bring poorer land up to standard quality. In this way ℓ_1 is eliminated from the

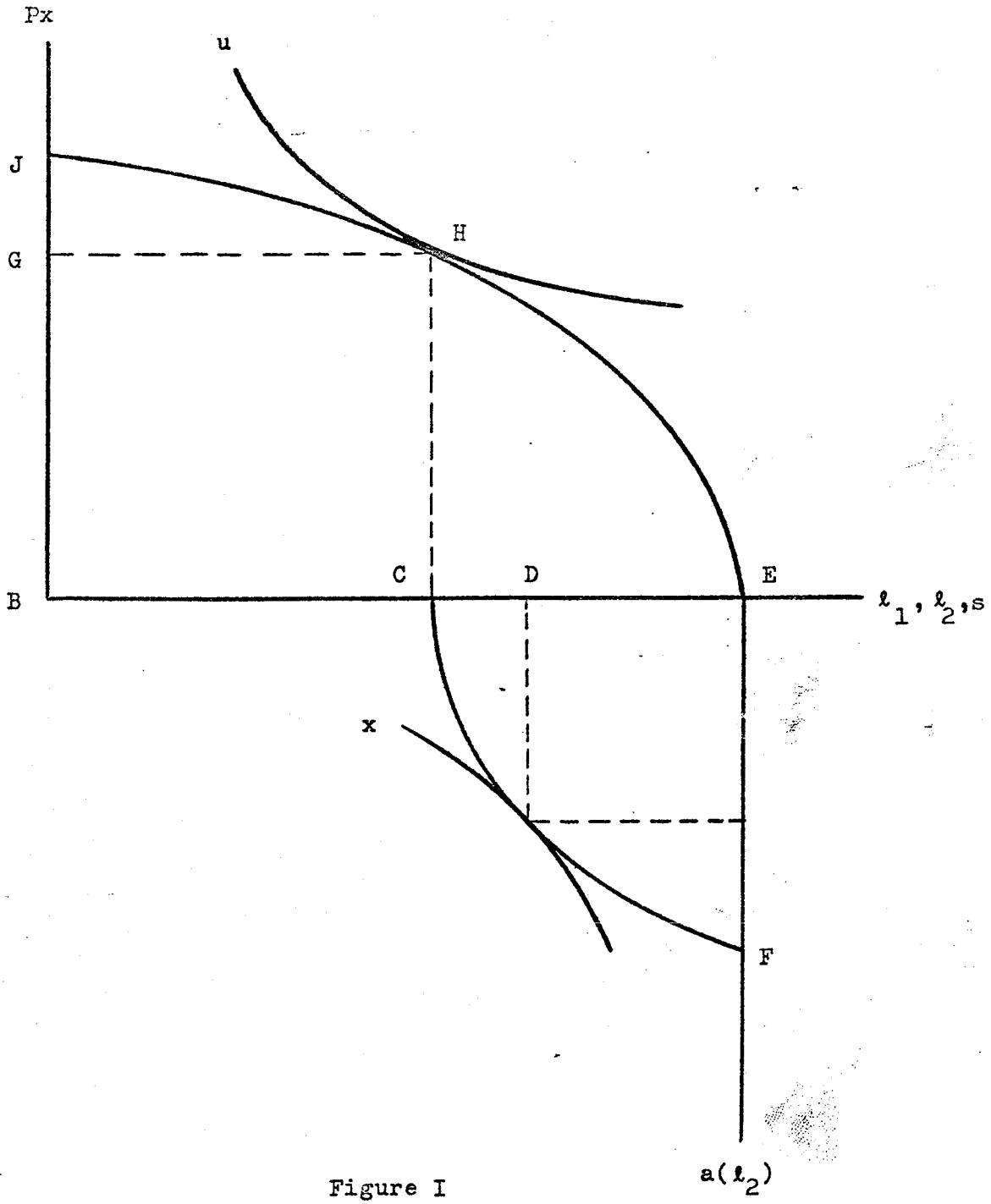

Figure I

production function, a not unrealistic assumption as long as there are not strong incentives to modify technique.[18] If we define units in such a way that $x = a(\ell_2)$, the first order equilibrium conditions are

$$-u_s + \lambda P\frac{da}{d\ell_2} = 0 \tag{7}$$

$$u_m - \lambda = 0 \tag{8}$$

$$P(a(\ell) - x^*) - m = 0. \tag{9}$$

Assuming that P is very low initially because of high costs of transportation and communication, the colonial government's efforts to open the region to trade may be thought of as equivalent to raising this price ratio. To examine the reaction of farmers to this action we differentiate totally equations (7) - (9) to obtain the following system:

$$\begin{bmatrix} u_{ss} & -u_{ms} & P\frac{da}{d\ell_2} \\ -u_{ms} & u_{mm} & -1 \\ P\frac{da}{d\ell_2} & -1 & 0 \end{bmatrix} \begin{bmatrix} d\ell_2 \\ dm \\ d\lambda \end{bmatrix} = \begin{bmatrix} -\lambda \frac{da}{d\ell_2} dP \\ 0 \\ -adP \end{bmatrix} - \begin{bmatrix} \lambda P\frac{d^2a}{d\ell_2^2} \\ 0 \\ 0 \end{bmatrix} \tag{10}$$

The effect on labor input of a change in P is then given by

$$(11) \qquad \frac{d\ell_2}{dP} = \frac{u_m \frac{da}{d\ell_2}}{|D|} - \frac{a(u_{ms} - P\frac{da}{d\ell} u_{mm})}{|D|} + \frac{u_m \frac{d^2a}{d\ell_2^2}}{|D|} \frac{d\ell_2}{dP} .$$

Since the determinant $|D|$ is positive, the sign of $d\ell_2/dP$ depends on the size of the first term, or substitution effect, relative to that of the second term, or income effect, and last term, or curvature effect which tends to mitigate the combined result of the first two effects.

Here we see explicitly the chief assumptions of the vent for surplus model. Given a high consumption of leisure and a low consumption of imported goods, it is expected that u_m will be relatively large and u_{ms} and u_{mm} relatively small. At the same time the existence of readily available surplus land of good quality implies that $da/d\ell_2$ is large and $d^2a/d\ell_2^2$ is small or zero over a considerable range. Consequently the substitution effect of the price change may be expected to dominate the income effect and not be lessened severely by diminishing returns at the extensive margin.

For any individual farm the positive effect on labor input of an improvement in its terms of trade cannot persist indefinitely in the absence of a labor market. It is rather the cumulative effect across space of changes in the prices faced by each farmer which, under these conditions, results in high rates of export growth. Aside from the response of individual farmers, however, the rate of growth of exports also depends on the speed with which prices are changed, and this is determined primarily by the pace of government investment.

One approach would be to assume that the government in each region is financially independent and ask how rapidly it can mobilize the resources for investment. This might lead to a model in which exports, stimulated by government expenditures, feeds back into the system by supplying the revenue base upon which the government can draw.[19] In the very early stages of growth, however, this model does not deal with the problem of how exports initially get started.

An extreme alternative, to be considered here, is to assume that a colonial government extends its power over many regions, obtains its resources from general tax revenue both in the metropole and in the colonies, and allocates these resources by central direction. We assume further the absence of any significant feedback effect of a region's own economic performance on the public resources available to it. Finally, it is supposed that the availability of these resources is limited to such an extent by political factors and the uncertainties connected with colonization that the marginal social product of public expenditures in at least some of the colonies is greater than in the mother country. The question we pose is, given the amount of public resources available annually to the overseas empire, how might these resources be allocated among regions and what is the effect likely to be of this allocation on the terms of trade facing farmers in each region.

Assume that the price ratio in the ith region is given by

(12) $$P_i = P(D_i, N_i/A_i, G_i, P_w)$$

where D_i is the per unit cost of transporting exports and imports to and from the world market, N_i is the population and A_i is the total land area of the region, G_i is the integral of all past government expenditures in the region, and P_w is the price ratio on the world market. A given investment of government expenditure in a region will be less effective in increasing P the lower the population density and the more remote is the region, i.e. $P_{GD} < 0$, $P_{GN/A} > 0$. If we assume that the government's objective is to maximize total exports from the colonies,[20] it will partition its resources so as to equalize all dX_i/dG_i where

(13) $$\frac{dX_i}{dG_i} = N_i \frac{da_i}{dG_i} = N_i \left(\frac{\partial P}{\partial G}\right)_i \left(\frac{d\ell_2}{dP}\right)_i \left(\frac{da}{d\ell_2}\right)_i.$$

Assume initially that P is everywhere so low that only subsistence needs are met. One possibility is the situation depicted in Figure II where the curve EJ, showing the value of output as a function of ℓ_2 instead of as a function of ℓ_1 and ℓ_2 as in Figure I, is so low that the constraint $x \geq x^*$ is binding and ℓ_2 is pushed to the left along EJ past the point of tangency. The equilibrium condition shown previously does not become effective until this curve has shifted upward to EJ' as a result of an rise in P. Any further increase in P, shifting the curve beyond EJ', results in

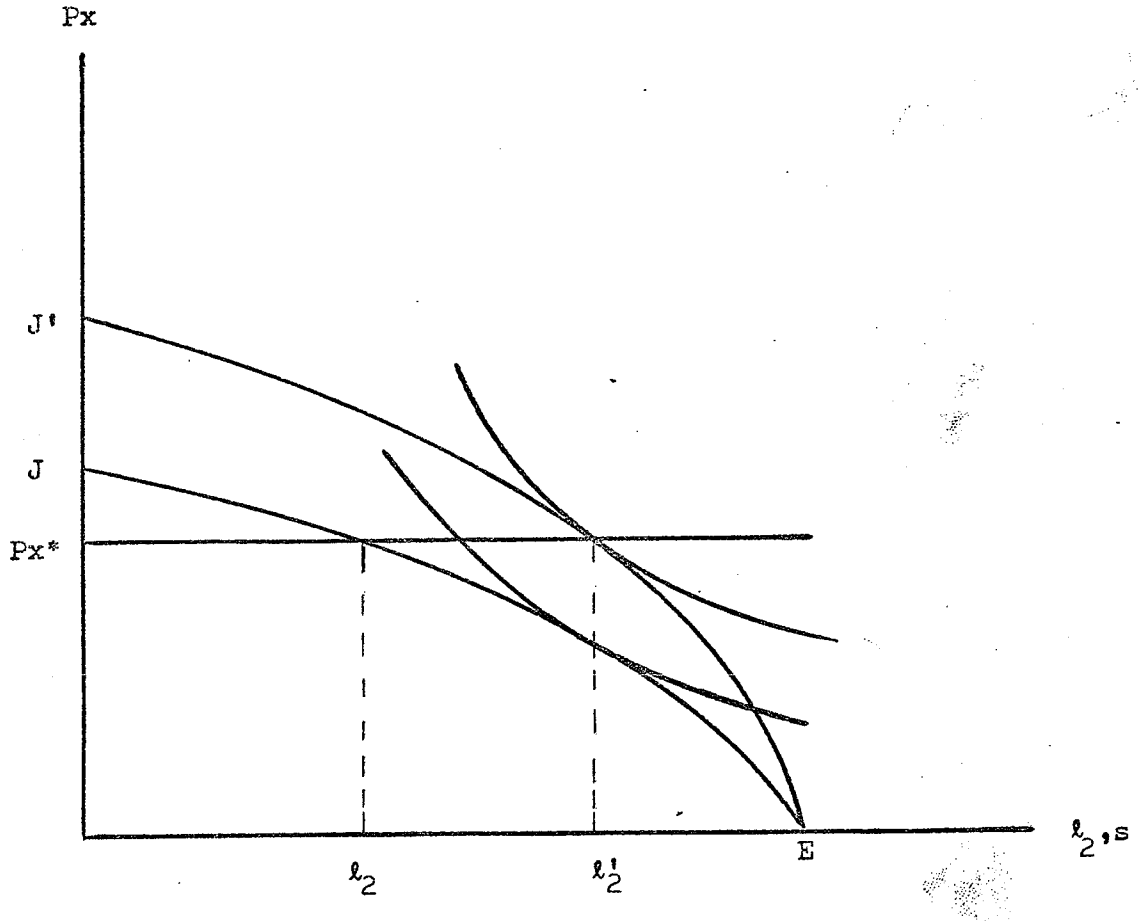

Figure II

trade as long as $d\ell_2/dP$ is positive. In order to avoid the discontinuity at this point we assume that each region has a sufficient stock of past government investment such that it is at the point of entering into trade.[21] If we further assume that utility functions and the level of subsistence needs in all countries are identical and that farmers everywhere face the same conditions of land quality, then $d\ell_2/dP$ and $da/d\ell_2$ are the same in all regions at this point.

Government expenditures will first be allocated to the region with the highest value of $N\left(\frac{\partial P}{\partial G}\right)$. If all regions are of equal size in terms of population, this first region will be that which has the lowest cost of external transportation and highest population density. As government expenditures cumulate, however, their impact on P is assumed to decrease, i.e. $P_{GG} < 0$. Furthermore, the values of $d\ell_2/dP$ and $da/d\ell_2$ will also decrease as more of the farmers' time goes into agricultural labor and as more land is brought into cultivation. Eventually it will pay the government to switch part of its expenditures to a second region, located perhaps further from the coast or having a lower population density. At the same time that it is pushing outward the boundary of commercialization, however, investment in the first region will be deepened to the extent necessary to continually equate dX/dG in both regions. As investment continues and the value of dX/dG is reduced further, more regions are brought into the orbit of trade.[22]

IV. The Effects of Immigration and Population Growth

Since some regions experience growth earlier than others, there is an incentive for labor to migrate from relatively undeveloped regions to those in which government infrastructure is more complete. Although immigrants in some cases may obtain land, more frequently it is expected that they will work for wages or some other form of compensation. Any single farmer may now expand cultivation to a greater extent than when he was dependent on his own labor since he now has access to unlimited labor at the prevailing wage W. Because he, too, could work for his neighbors, the opportunity cost of his own labor also equals W.

Under these conditions the farmer seeks to maximize the return on his land,

$$r = P\,(a(t_2) - x^*) - W\,t_2, \tag{14}$$

where t_2 is the total labor time per farm of both family and hired labor.

The first order condition for maximization is simply

$$\frac{da}{dt_2} = \frac{W}{P}\,. \tag{15}$$

With the real wage rate determined outside the region, the choice between leisure and wage labor is made independently of the decision of how much land to farm. Variations in the terms of trade, resulting either from

changing world market conditions or from further government investment, will influence the total labor input of each farm by

$$\frac{dt_2}{dP} = -\frac{W}{P^2}\left(\frac{d^2a}{dt_2^2}\right)^{-1}, \tag{16}$$

which is positive. As d^2a/dt_2^2 approaches zero, the value of this derivative approaches infinity. Thus, given an adequate supply of labor and an abundant supply of land/good quality, growth can be very rapid indeed. This is true even if the subsistence needs of immigrant labor as well as members of the family must be met prior to the sale of the agricultural surplus. In this case equation (15) becames

$$\frac{da}{dt_2} = \frac{W}{P} + x^*. \tag{17}$$

The real wage now includes the subsistence needs of workers as well as the real value in terms of exports of the wages paid each as imported goods. As long as the marginal product of labor is above this total real wage, it pays to hire more workers and to expand cultivation.

Eventually, however, diminishing returns begin to be felt more seriously as farming is extended into truly marginal areas. As a result, there is an incentive to alter the technology and to use more labor intensive techniques on all cultivated land. To show

this we return to our previous case in which total labor is divided into t_1 and t_2 which now includes hired as well as family labor. The first-order equilibrium conditions are given by

$$x_{t_1} - \frac{W}{P} = 0 \tag{18}$$

$$x_a \frac{da}{dt_2} - \frac{W}{P} = 0, \tag{19}$$

which may be differentiated totally to obtain

$$\begin{bmatrix} x_{t_1 t_1} & x_{t_1 a} \frac{da}{dt_2} \\ x_{t_1 a} \frac{da}{dt_2} & x_a \frac{d^2 a}{dt_2^2} + x_{aa} \left(\frac{da}{dt_2}\right)^2 \end{bmatrix} \begin{bmatrix} dt_1 \\ dt_2 \end{bmatrix} = \begin{bmatrix} -\frac{W}{P^2} dP \\ -\frac{W}{P^2} dP \end{bmatrix} \tag{20}$$

If it assumed that the production function $x = x(t_1, a)$ is homogeneous of degree one, the determinant of equation (20) is positive and the stability condition is satisfied. This may be seen by evaluating the determinant and substituting $x_{t_1 t_1} = -\frac{a}{t_1} x_{t_1 a}$ and $x_{aa} = -\frac{t_1}{a} x_{t_1 a}$, which are true because of the assumption of constant returns,[23] to obtain

$$|D| = -\frac{a}{t_1} x_{t_1 a} x_a \frac{d^2 a}{dt_2^2}, \tag{21}$$

which is postive. Thus even though there are constant returns to scale in the use of t_1 and a, the variation in land quality limits profitable production.

The effects of further increases in the terms of trade are given by

$$\frac{dt_1}{dP} = \frac{W}{P^2|D|}\left(x_{t_1} a \frac{da}{dt_2} - x_a \frac{d^2a}{dt_2^2} - x_{aa}\left(\frac{da}{dt_2}\right)^2\right) \tag{22}$$

$$\frac{dt_2}{dP} = \frac{W}{P^2|D|}\left(x_{t_1} a \frac{da}{dt_2} - x_{t_1 t_1}\right), \tag{23}$$

both of which are positive. These effects are illustrated in Figure III, which is similar to Figure I except that the objective is to maximize the difference between total receipts, given by EJ, and total wages including the opportunity cost of family labor, shown by EK. Given an upward shift to EJ', the equilibrium level of output increases, expanding the opportunity locus for converting labor into hemogeneous land, and t_1 and t_2 are increased to t_1' and t_2'. Note the importance, too, of being able to apply labor at the intensive as well as at the extensive margin. Instead of shifting outward along both axes proportionately, the opportunity locus shows the diminishing returns to using progressively poorer land. The result is a shift in the slope of that curve as we move outward along a ray from the origin, inducing the use of more labor intensive techniques. If farmers did not have the option of altering their technique, they would, by maintaining the same factor proportions, be forced to produce less output x'' instead of x'. The increase in P, then, permits the marginal physical product of labor to be decreased on both the extensive and intensive margins as more labor is allocated in both of these directions.

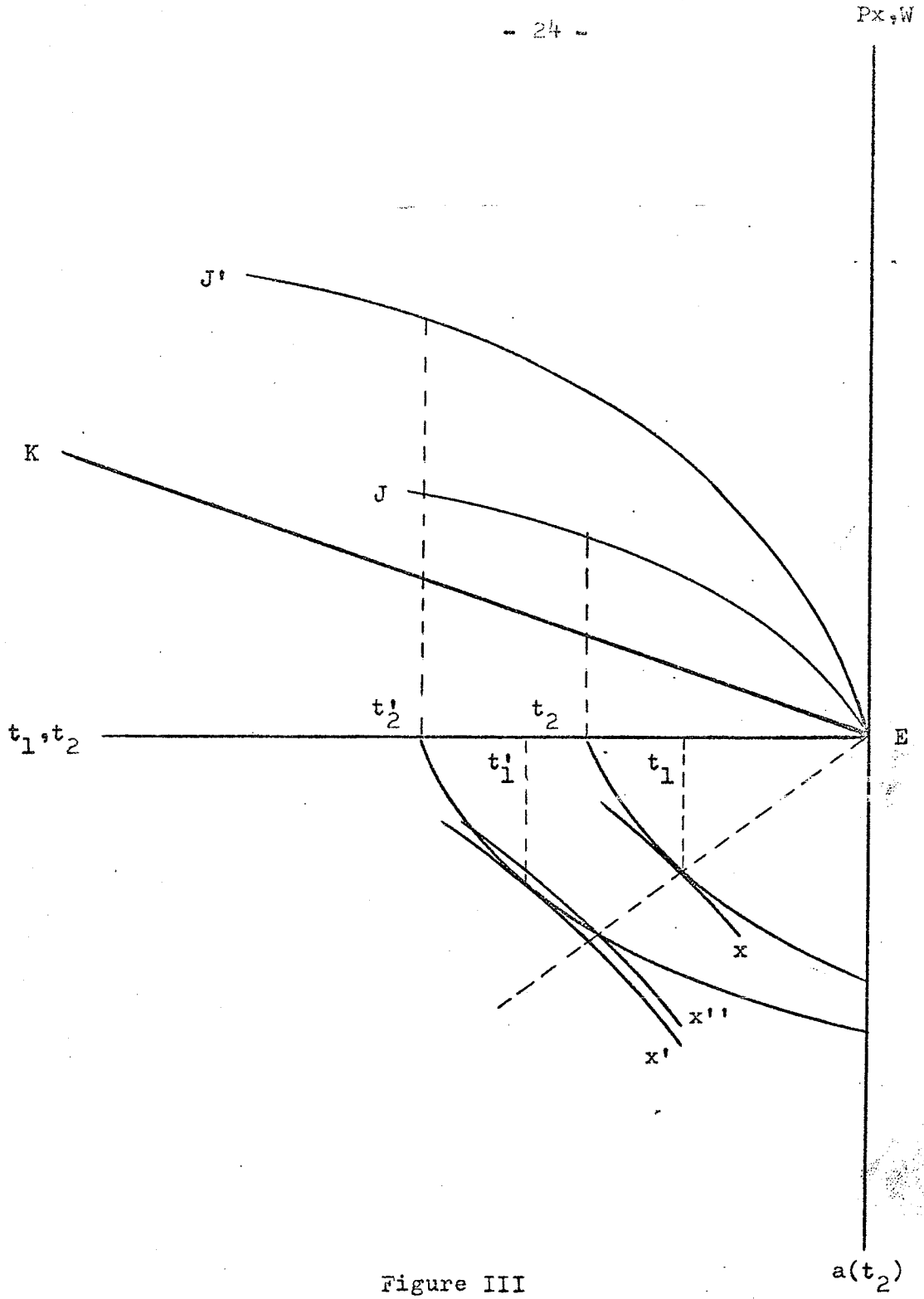

Figure III

Aside from immigration, the growth of government infrastructure and the increases in income associated with commercial agriculture act to accelerate the rate of growth of population. The first effect is to raise x^*, the food requirements of family members on each farm. Although this tends to lower per capita income, it does not affect the choice of technique or how much land to cultivate provided it is not a binding constraint.

As children grow old enough to work in the fields, they may begin to displace some hired labor. As long as there is net immigration, however, wages are determined outside the region and no change in technique results if P remains constant. As the land is increasingly filled with local inhabitants and immigration ceases, however, unemployed immigrant workers, who have already overcome the cost barrier of migration, are willing to take a cut in wages rather than return home. Wage reductions have a result analogous to price increases, that is they encourage expansion at both the extensive and intensive margins. At the limit, however, wages cannot fall below the subsistence level, and even before that out migration may occur to absorb unemployed labor.

Thus far it has been assumed that land holdings remain fixed. As farm families grow in size, however, there will be pressure generated to break up the original holdings into a greater number of smaller units. As this occurs the marginal product of labor per farm used to improve land decreases for a given amount of this input. Mathematically, this is a change in da/dt_2, the effect of which is given by

$$(24)\qquad \begin{bmatrix} x_{t_1t_1} & x_{t_1a}\frac{da}{dt_2} \\ x_{t_1a}\frac{da}{dt_2} & x_a\frac{d^2a}{dt_2^2} + x_{aa}\left(\frac{da}{dt_2}\right)^2 \end{bmatrix} \begin{bmatrix} dt_1 \\ dt_2 \end{bmatrix} = \begin{bmatrix} 0 \\ -x_a\, d\left(\frac{da}{dt_2}\right) \end{bmatrix},$$

$$(25)\qquad \frac{dt_1}{d\left(\frac{da}{dt_2}\right)} = + \frac{x_a\, x_{t_1a}\frac{da}{dt_2}}{|D|}, \text{ and}$$

$$(26)\qquad \frac{dt_2}{d\left(\frac{da}{dt_2}\right)} = - \frac{x_a\, x_{t_1t_1}}{|D|},$$

Since the determinant is positive, a decrease in da/dt_2 results in a decrease in t_1 as well as in t_2.

Diamgrammatically the situation is depicted in Figure IV. The original opportunity locus CF is shifted to CF' as a result of the reduction of per farm land area. It is now more difficult to substitute land for labor so that only a lower level of output x' could be produced using the same amount of labor CE. But the more labor intensive technique used to offset, in part, the higher implicit cost of land, is not tenable since labor must still be paid the same real wage as before. Consequently the size of the labor force must be contracted to C''F, at which point the marginal product of labor at both the extensive and intensive margins is again equal to the real wage, and equilibrium is at a point of tangency with the land-labor ratio unchanged. That there is no change in this ratio may be seen by dividing equation (25) by equation (26) to obtain

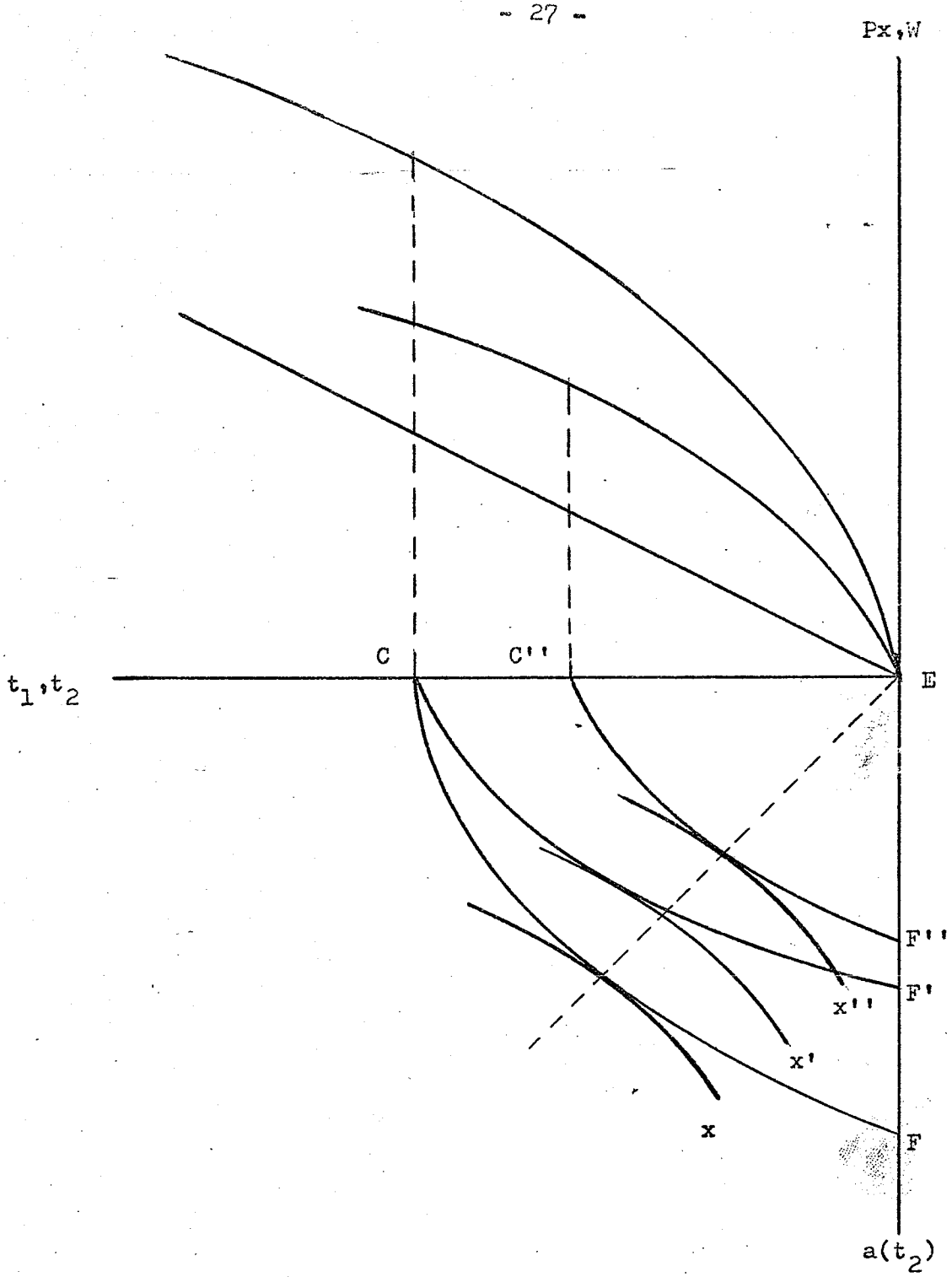

Figure IV

(27) $$\frac{dt_1}{dt_2} = -\frac{x_{t_1 a}\frac{da}{dt_2}}{x_{t_1 t_1}} = \frac{t_1}{a}\frac{da}{dt_2}$$

or $$\frac{dt_1}{da} = \frac{t_1}{a}.$$

As long as agricultural wages are exogenously determined, either by migration to or from other regions or by some minimum standard of living, intensification of agricultural techniques does not take place. To the extent that family labor displaces hired labor as the local population expands, farming becomes decreasingly commercial on the labor input side, and per capita incomes in the form of land rents decrease. Utltimately, hired labor is no longer to be used at all, and the situation reverts to that examined at the beginning of the previous section,[24] where the marginal product of family labor is equated at the extensive and intensive margin and labor is used up to the point where the value of its marginal product is equal to the marginal rate of substitution between leisure and imported goods, i.e.

(5) and (6) $$Px_{\ell_1} = Px_a \frac{da}{d\ell_2} = \frac{u_s}{u_m}.$$

Equilibrium is established under the same conditions but with the marginal product of labor at a much lower level than was the case when land was sparsely settled. Since the marginal utility of consumption of imported goods is relatively high now that per capita incomes have fallen, labor

input is likely to be pushed further than when its utilization depended on real wages. Its marginal product may even fall below the rate which would be necessary to support subsistence. Nevertheless, part of output continues to be sold as long as it is still greater than subsistence needs, distribution among individuals being handled within the family. If population continues to grow and there is no out migration, however, eventually total output will just be sufficient to supply subsistence to each member of the family, i.e. the constraint $x = x^*$ is binding, and all labor input goes just to keep the family alive. This is the process of involution carried to its extreme.

V. Conclusion

The preceeding analysis helps to clarify and make explicit some of the assumptions and implications of the vent for surplus pattern of growth and its possible aftermath. We have seen, for instance, that in the absence of sustained improvements in the terms of trade facing a whole range of farmers, the export supply response to the provision of government infrastructure, though positive under the assumptions of the model, is choked off at same point as farmers shift from leisure to the purchase of imported goods. High rates of government expenditure could generate continuous rapid increases in export production as different farmers successively reallocate their resources in response, for example, to the completion of new feeder roads, but the colonial period prior to

World War II, during which time many areas experienced very rapid export growth, was not one of sustained expansion of colonial government expenditures. Our model predicts, however, that even if infrastructure is not expanded rapidly, export growth rates can be very high if there is a source of immigrant labor capable of farming open land. The experience of most countries which have undergone rapid rates of growth of this sort has, in fact, been one in which migration has played an important role at some time.[25]

We have also investigated the effect which immigrant labor has in maintaining a relatively stable wage rate until the best land is all under cultivation. Thereafter, expansion may still take place to the extent that the terms of trade are improved in certain regions, but not at the extensive or intensive margins in regions in which P is fixed. Only when immigration ceases is there likely to be a period of labor intensification as the wage rate drops in response to expanding population. During this period, too, we would expect to see rents increase absolutely as well as relative to wages. Whether exports expand or contract depends upon the rate of increase of population with its requirements for subsistence, the rate of decline of wages, and the rate at which output is increased in response to the wage decline. Eventually, wages fall to the point at which emigration occurs and the process of involution begins in earnest as hired labor is replaced with family labor. Since wages are once more fixed, there can be no expansion of output, and exports must contract as food requirements

increase. Finally, if emigration ceases, techniques become increasingly labor intensive and exports continue to contract to the vanishing point.

The irony of this situation is that it is the provision of public services and government infrastructure which sparks both the growth of exports and income and the growth of population. But the full impact of population growth is not likely to be felt for some number of years after exports have begun to grow rapidly, and frequently only after most of the surplus land of good quality has been already brought into cultivation.

There are several ways, however, in which the economy might evolve along different lines. One possibility is for agriculture to shift to full-scale commercialization, substituting higher valued export products for the traditional crops grown for food. Unless they are able to diversify production, however, farmers may find themselves precariously dependent on the vagaries of monoculture in a fluctuating world market, without the security of their own subsistence sector.

Alternatively, labor-using technological change in agriculture might enable the rural sector both to increase its per capita income and to employ more people. This is likely to call for greater rather than less commercialization on the input side. Or labor may shift out of agriculture and into manufacturing and tertiary activities in the manner depicted by the models of development of the dual economy.

All of these imply some reorganization of the agricultural sector and the creation of new institutions. To the extent that

the government can assist in this reorganization it is important that the surplus resources created during the vent for surplus phase of growth not be squandered. The capacity for this type of growth is a valuable resource which is likely to be available only once in any nation's history. It is the government, colonial or independent, which takes the leading role in making this resource of value and which has the responsibility to mobilize it in such a way as to provide for future needs.

Footnotes

[1]Hla Myint, "The 'Classical Theory' of International Trade and the Less Developed Countries," Economic Journal, Vol. 68 (June 1958). The only works in which this type of growth has been treated at all rigorously, to my knowledge, are Richard E. Caves, "'Vent for Surplus' Models of Trade and Growth," in Robert E. Baldwin, et al, Trade, Growth, and the Balance of Payments--Essays in Honor of Gottfried Haberler (Chicago: Rand McNally, 1965) and Ronald Findlay, Trade and Specialization (Middlesex, England: Penguin Books, 1970), pp. 70-76. Caves's discussion is concerned more with the implications for the pattern of world trade and production of the opportunity to employ inputs with no alternative uses in the export sector, while the concern of Findlay and myself is related more to the circumstances under which vent for surplus growth arises.

[2]See Findlay, op. cit., and Stephen Hymer and Stephen Resnick, "A Model of an Agrarian Economy with Non-agricultural Activities," American Economic Review, Vol. 59 (September 1969).

[3]See, for example, Polly Hill, The Migrant Cocoa--Farmers of Southern Ghana; A Study in Rural Capitalism (Cambridge: The University Press, 1963). This is not to say that profound social changes do not occur as a result of the expansion of export crops but rather that they are not a prerequisite to that expansion.

[4]The type of colonial economy envisaged is patterned after the French empire of the first half of the twentieth century especially with respect to the degree of centralization of investment decisions.

[5]William Allan, The African Husbandman (New York: Barnes and Noble, 1965); Ester Boserup, The Conditions of Agricultural Growth: The Economics of Agrarian Change under Population Pressure (Chicago: Aldine, 1965); Karl J. Pelzer, Pioneer Settlements of the Asiatic Tropics; Studies in Land Utilization and Agricultural Colonization in Southeastern Asia (New York: American Geographical Society, 1948).

[6]Findlay, op. cit., p. 72. This is also the focus of the article by Hymer and Resnick cited previously.

[7]Findlay probably goes to far in saying that with the opening of trade farmers prefer to buy imports only because they are cheaper than local handicrafts. Although there is some degree of substitutability between these two types of goods, it is not great. Although cash crop farmers throughout the world do not appear to be limited in their desired consumption of modern manufactures, it is doubtful if they would acquire an unlimited amount of handicrafts even at a price of zero.

[8]H. Brunschwig, Mythes et Réalités de l'Impérialisme Colonial Francais (1871-1914) (Paris: Armand Colin, 1960).

[9]Hla Myint, The Economics of the Developing Countries (New York: Praeger, 1965), pp. 29,30.

[10]Clifford Geertz, Agricultural Involution; the Process of Ecological Change in Indonesia (Berkeley: University of California Press, 1963).

[11]Myint, op. cit., pp. 49-51.

[12]Myint, "The 'Classical Theory'....", p. 331n.

[13]Ibid., p. 330.

[14]Findlay, op. cit., p. 76.

[15]Lower-case letters represent per farm variables.

[16]Thus s includes time spent in non-agricultural productive activities as well as leisure in a strict sense. For our purposes it is not important to separte these since we are only interested in the utility derived from this time, either directly in the form of leisure or indirectly in the form of goods and services produced at home.

[17]The assumption of a given per capita subsistence food requirement is the limiting case of the general assumption noted in the previous section that the low opportunity cost of leisure is in part due to the low marginal utility of additional food consumption after subsistence needs are met.

[18]The assumption of unchanged technique in agriculture is made both by Myint and by Findlay in analyzing the vent for surplus stage of growth. Later when we discuss the point at which most good land is exhausted, we will reintroduce the possibility of varying technique on land of constant quality.

[19]A model of this type has been estimated empirically for ten countries by Thomas Birnberg and Stephen Resnick, "A Model of the Trade and Government Sectors in Colonial Economies," Center Discussion Paper No. 130 (Economic Growth Center, Yale University, November 1971).

[20]From an overall social point of view, this objective is inferior to that of equalizing the marginal social product of public expenditure throughout the colonial empire. Given the uncertainties connected with the early stages of colonial rule and given the colonial government's dependence upon foreign trade for tax revenues, however, this is a more likely, if partial, immediate objective, which seems to be amply documented in the official literature of the French empire. An alternative objective, which leads to very similar results, is that in the presence of great uncertainty concerning the potential for export of different regions of the empire, resources were allocated initially so as to provide at least a minimum level of colonial administration to each inhabitent of that empire, starting with those nearest the coast and working inland.

[21]This is not an unreasonable assumption if the colonial government has already succeeded in successfully establishing some minimum level of administration throughout the empire, an objective suggested in the previous footnote, since this implies at least a rudimentary transportation and communications system.

[22]If land qualitity varies between regions, of course, initial values of $d\ell_2/dP$ and $da/d\ell_2$ will also vary, and the allocation of expenditures will be correspondingly affected. In the presence of considerable uncertainty concerning the agricultural potential of tropical environments which persists even today, however, investment decisions are likely to have been heavily influenced by the better understood relationship expressed in equation (12). As an example, the western part of Senegal, an area close to the sea devoted to peanut cultivation, is much more heavily developed than many other parts of former French West Africa despite the fact that its climate and soil are relatively poor agriculturally. See Benjamin E. Thomas, Transportation and Physical Geography in West Africa (Department of Geography, University of California, Los Angeles, 1960), p. 8.

[23]R.G.D. Allen, Mathematical Analysis for Economists (London: Macmillan, 1962), pp. 317, 18.

[24]We are assuming that the local population, in contrast to immigrants, are unwilling to emigrate to the sparsely populated, undeveloped regions even though subsistence needs may be satisfied much more easily there than in their own densely populated area. One reason for this could be that the shift in consumption patterns from leisure to imported goods is not easily reversible.

[25]The experience of Ghana, examined by Polly Hill, op. cit., is one of the best known examples.