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SOME WELFARE ASPECTS OF INTERNATIONAL MIGRATION

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Some Welfare Aspects of International Migration

It has long been a contention of underdeveloped countries and even of relatively developed ones, that the emigration of highly skilled personnel constitutes a serious loss which the country should try to minimize. While the idea has seldom been expressed in highly theoretical terms, most people have accepted it intuitively and hardly questioned the underlying theory. Recently, however, the generally accepted point of view has been called into question by Grubel and Scott,[1] who argue that under most circumstances there is no loss to the non-migrants as a result of emmigration, even of highly skilled personnel, from a given country.

The present discussion attempts to analyze in considerable detail the conditions under which loss to the remaining population[2] will occur, considering the possibility of emigration either of skilled or unskilled labor. It is concluded that, in general, loss does occur, although there are a few cases where gain (or no change) may result.

In the first case discussed, it is assumed that the emigration is a once and for all affair and that the supply of resources to the domestic economy is perfectly inelastic. Because of the latter assumption, this case may be thought of as referring to the very short run, in which resource supplies do not adjust to the impact of the migration. It is a relatively

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[1] Grubel, Herbert B. and Anthony D. Scott, "The International Flow of Human Capital." American Economic Review, May 1966.

[2] It is assumed that the emigrants themselves gain from the move; the welfare function with which we are concerned deals solely with non-migrants and disregards an individual as soon as he migrates. Problems are implicit in this definition but we will not go into detail about them.

Since the emigrants are excluded from the national welfare function, it is particularly necessary to assume away interpersonal utility effects between emigrants and their friends or families who do not emigrate. Although virtually all of consumer theory is based on the assumption of independent utility functions, such an assumption may be particularly ill-suited to the analysis of the question at hand, and will be relaxed in this paper.

simple case; the major determinants of the extent of gain or loss are (a) the ratio of per cent of all capital held by emigrants to per cent of all labor supplied by emigrants, and (b) the amount of their physical capital which the emigrants take with them. It is clear also that such things as the existence of external effects related to the emigrants, or increasing returns to scale, can affect the results but the only interesting question is whether such effects are quantitatively important, since their direction is theoretically obvious.

The analysis becomes more complex when readjustment of factor supplies and factor proportions to the migration is allowed for. If there are only two factors, the results depend on the relative savings propensities of emigrants and non-emigrants, and on whether the emigrants take their capital with them or not. Results are summarized in Table 2, farther on. When there are three or more factors (permitting the distinction between skilled and unskilled labor) the result depends jointly on the relative savings propensities, the skill levels of migrants and non-migrants, the ease of transforming unskilled into skilled labor, and the existence of government subsidies to education.

The Short-Run Effects of Emigration

To initiate the analysis in the simplest possible framework assume the following: perfect markets, no external effects, constant returns to scale, independent utility functions (in the sense that one person's indifference level does not affect that of another person), and a two-factor world, in

which one factor is capital and the other is homogeneous labor. Factors are continuously substitutable and prices are flexible so that factor markets are always cleared. The marginal utility of income is assumed to be equal for all owners of factors of production.

The effects of an emigration on the income of the non-emigrants depends on the way in which the ownership of the capital stock is distributed among the people in the country, and whether the emigrants take their physical capital with them or receive instead the remuneration corresponding to the return on physical capital, which they leave behind them.

Assume first the simplest possible case in which none of the laborers who migrate own any of the capital stock. Here it is clear that as long as the marginal physical productivity of labor is declining, the individuals left in the country after the migration are worse off than they were before it. This is illustrated diagrammatically in Figure I. The marginal physical product of labor curve is designated by MPP_L, and the initial labor stock, measured on the horizontal axis, is OL_1. Total product is given by the area beneath the marginal physical product of labor curve, i.e., $OACL_1$. Suppose now that L_2L_1 workers emigrate reducing the labor force to OL_2. The new total product of the economy is given by the area $OABL_2$. Whereas the original equilibrium wage rate was OE, the new and higher wage rate is OF. Since the migrants own no capital stock, their income before migrating is L_2DCL_1. The income of the rest of the population at this time is therefore $OACDL_2$. After the migration the income of the remaining inhabitants is $OABL_2$, less than their original level by the triangle BCD.

Note that in this case, the average income per person in the nation (which corresponds to a different set of people before and after the migration),

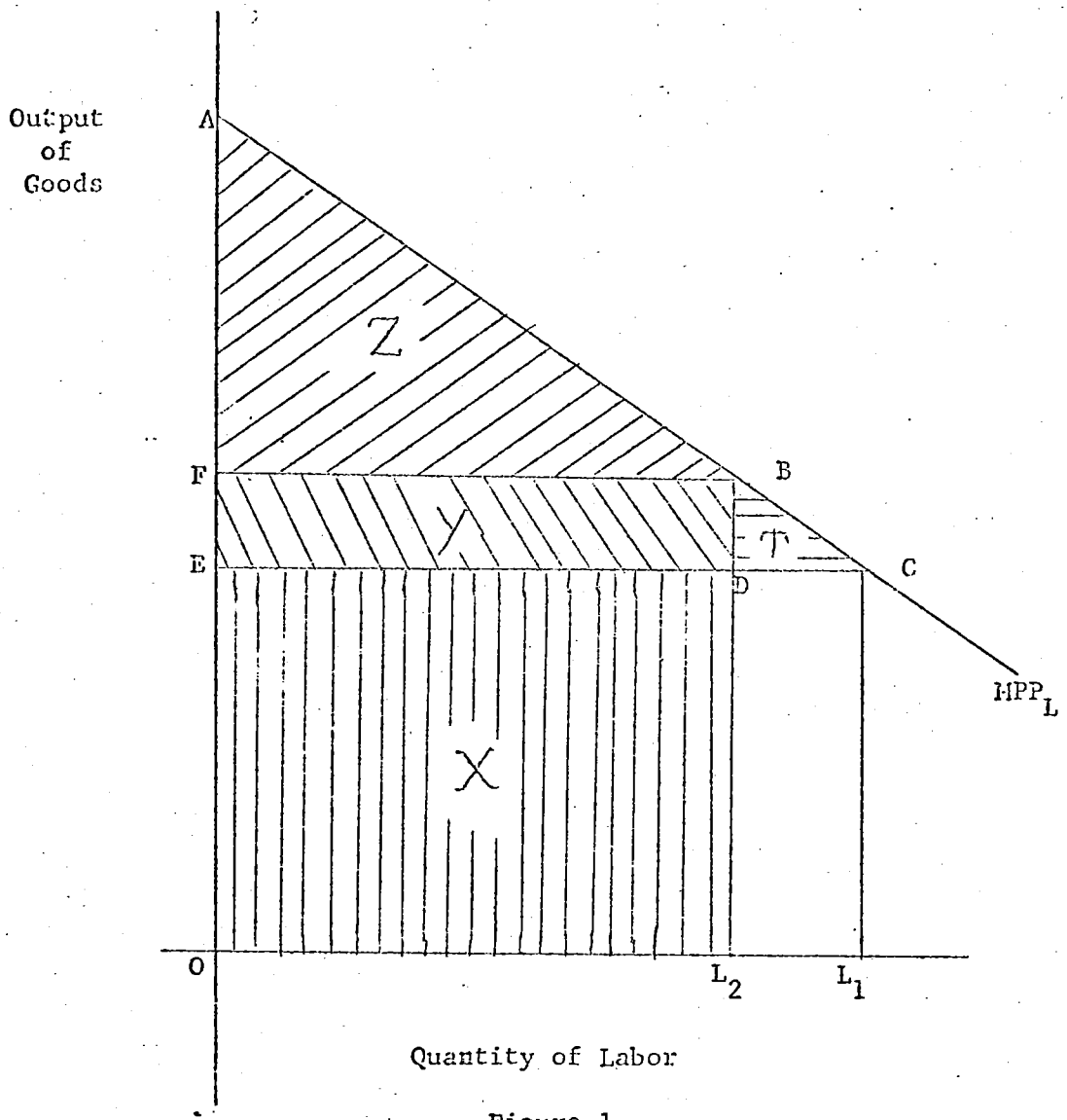

Figure 1

increases as a result of the migration, even though the average income of that particular set of persons remaining in the country is lowered.[1] This superficial paradox can be explained by the fact that the emigrants (since they owned no capital) had a below average income level before their migration.

Consider now an alternative in which the ownership of the capital stock is equally distributed among all the individuals in the population, each of whom also belongs to the labor force which, as before, is assumed to be homogeneous. Assume also that an individual who leaves the country still owns his capital and receives the appropriate factor payment. Again we ask ourselves whether the income per person of the set of individuals remaining in the country is greater before or after the emigration. Consider Figure 1 again. Define n such that $\frac{L_2L_1}{OL_1}$ equals $\frac{1}{n}$, i.e., suppose that one nth of the population has decided to emigrate. This tells us that the income of the non-migrating group before the migration occurred was equal to $X + \frac{n-1}{n}(Z + Y + T)$, where X is equal to the area $OEDL_2$, Z is equal to the area ABF, Y is equal to the area $FBDE$, and T is equal to the area BCD. After the migration has occurred the income of the remaining population is given by $X + Y + \frac{n-1}{n}(Z)$. It is easy to show that the income before the migration is in this case less than the income after the

[1] We assume implicitly throughout this paper that there is a constant ratio between the labor force and the total population both as between emigrants and non-emigrants and through time. To the extent that this is not true, conclusions which can be drawn as to the effects on the income per worker do not imply parallel statements as to the effects on income per person.

migration.[1,2]

The conclusion that emigration can help the remaining population only if the emigrants were owners of some capital stock, but is sure to hurt the remaining population if the emigrants did not hold any capital stock, is at first sight rather paradoxical. One might have expected that since the emigration of labor increases the capital labor ratio that the remaining inhabitants would be better off in the latter case. But it is here that the distinction must be carefully made between changes in the income level of the group of people who were in the country before the emigration and still there after it, and changes in the average income level of all the people in the country before the emigration and all the people in the country after it. The average income of the people in the country at the respective before and after dates does increase

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[1]For this to be true we require only that

$$Y + \frac{n-1}{n}(Z) > \frac{n-1}{n}(Z + Y + T).$$

Subtracting $\frac{n-1}{n}(Z)$ from each side we get:

$$Y > \frac{n-1}{n}(Y + T),$$

which reduces to:

$$Y > (n-1)T .$$

It is obvious from Figure 1 that this inequality holds.

[2]The analysis of this section has been based on the assumption that the marginal physical product curve of labor is declining throughout its entire range. It is clear that our conclusion that the non-emigrants are worse off if the emigrants hold no capital stock is not qualified by the shape of the marginal physical productivity curve, as long as there is an equilibrium where the curve is downward sloping. Since distribution theory breaks down if this is not true we can limit ourselves to this case. When the emigrants do own the same amount of capital per person as the non-emigrants, the result just achieved can be reversed, even when an equilibrium exists.

as a result of the emigration, but this is consistent with a decrease in the income of the set of people who remain in the country.

Given the two cases just discussed, it is clear that there exists in this model some ratio of ownership of capital per emigrant to ownership of capital per non-emigrant at which the non-emigrants will be left just as well off as they were before the migration. This situation occurs when the per cent of all capital held by the non-emigrants is equal to $\frac{Y}{Y+T}$ [1,2]. This condition implies that non-emigrants hold a larger per capita share of the capital stock than emigrants.[3]

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[1]Proof:

Let a = % of all capital stock held by non-emigrants.

Then the incomes of non-emigrants, before migration and after migration respectively, can be represented as follows:

$$\text{before:} \quad X + a(Z + Y + T)$$

$$\text{after:} \quad X + Y + aZ$$

For equality we require

$$a(Z + Y + T) = Y + aZ ,$$

i.e.,

$$a = \frac{Y}{Y + T}$$

[2]When the MPP curve of labor is not a decreasing function of labor input throughout its entire range, the critical distribution of capital stock which has the property that emigration will not affect the incomes of non-emigrants will differ from the case treated here.

[3]The proportion of non-emigrants in the "before migration" population is $\frac{n-1}{n}$. From Figure 1 it is seen that $\frac{n-1}{n} = \frac{ED}{EC}$ If the proportion of the total capital stock held by non-emigrants is $\frac{Y}{Y+T}$ then the per capita holding of capital stock by non-emigrants is larger than that by emigrants, since,

$$\frac{Y}{Y+T} > \frac{ED}{EC} \quad \text{or} \quad \frac{Y}{Y+T} > \frac{n-1}{n} .$$

Until now it has been assumed that if an emigrant did own physical capital or the rights to it he did not take it with him when he emigrated. Consider now the case where the emigrant does take his capital with him.[1] In this context the following proposition is very useful:

> Given constant returns to scale, whenever a bundle of factors is removed from an economy and the relative amounts of the different factors in that bundle are not the same as the relative amounts of the factors in the economy as a whole before the removal, then the average income of the individuals left in the economy after the migration will be lower than it was before; if the relative proportions are the same, the average income of the individuals left in the economy will be unchanged.[2,3]

Applying this proposition to the extreme cases, we conclude that if a group of laborers who own no capital stock leaves then there is a decrease in the income of the remaining population (as we have already see above); on the other hand, if the entire stock of physical capital is removed, again the average income of the remaining population is decreased. More generally,

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[1]When human capital is introduced its departure along with the basic labor component must clearly be allowed for. In the case of physical capital, if the emigrant sells a stock, for example, this may lead to a decrease of the country's capital stock in the long run, as stock flotation becomes more expensive. The result, therefore, may be the same as if he had "carried" the stock off with him.

[2]It is assumed throughout this paper that any non-labor factors which leave the country as a result of the migration are owned by the migrants themselves.

[3]This proposition is a sort of analogue of the general theorem in international trade that whenever trade in goods or movements of factors between two previously closed economies is made possible then the income of each economy is increased as a result of the contact with the other one, provided that factor proportions were not the same in the two economies before trade. But if factor proportions were the same before the opening up of trade then no trade or factor movement will occur and no gains will be reaped.

whenever the labor and capital which leave the economy are not in the same proportion as in the pre-migration economy then there is a decrease in the per capita income of the remaining population.[1]

The results of this section are summarized in Table 1.

The Case of More Than Two Factors

The existence of different types of labor, or the existence of land as a factor of production changes the analysis to the extent that it may no longer be possible to assume that the area under the marginal productivity curve of the factor is equal to the total output. The shape of such a marginal physical productivity curve depends on the extent to which other factors are substitutable for or complementary with the factor in question. If some other type of labor is a very close substitute, then the marginal productivity curve will be relatively flat. If the factor has no close substitutes, then its marginal physical productivity curve will tend to be more steeply sloped.

The original conclusions which were drawn from Figure I in the case of a homogeneous labor force which owned no capital remain true in the case of any sub-sector of the labor force whose members do not own capital. Whenever a non-marginal proportion of this labor force emigrates the loss triangle appears. Someone in the remaining population must be worse off. It is not possible to perform the same simple diagrammatic analysis of the effects on the remaining population if the type of labor that emigrates does indeed own capital; for this one would need a more complicated production function

[1]It is clear that our results here, as in previous sections, would be modified if there were either increasing returns to scale or decreasing returns to scale in the economy. In general, the loss resulting from the departure of any factor would be greater if there were increasing returns and less if there were decreasing returns.

Table 1

Summary of Results in the Short-Run or Static Case with Two Factors

α [1]

Capital Owned Per Person by Emigrants / Capital Owned Per Person by Non-Emigrants	Emigrants Don't Take Capital	Emigrants Take Capital
$0 \leq \alpha < 1$	Loss increases ↑ No change	Loss increases ↑
$\alpha = 1$		No change
$\alpha > 1$	Gain increases ↓	Loss increases ↓

1. α = Ratio of Capital Owned Per Person by Emigrants to Capital Owned Per Person by Non-Emigrants.

Note: "Gain" and "Loss" as elsewhere in this paper, refer only to the non-emigrants.

approach in which all types of labor and capital were introduced and the effects of the departure of a certain number of a particular type of labor could be calculated. In any case, however, the conceptual apparatus which one must use is relatively clear-cut and simple.

The Long Run: The Dynamic Stationary Economy; Factor Proportions Analysis and Educational Costs

So far, it has been assumed that the total stock of each factor is fixed in a timeless sort of way, with changes occurring only as a result of migration, and with these changes not being made up for in any way afterwards, as, for example through the creation of more of a factor when its price rises. Consider now a model which, although still a very oversimplified version of reality, permits the introduction and analysis of some of the longer run effects of emigration. It is a stationary equilibrium model in which, in the absence of emigration, it is assumed that although people are born and die and factories are built and wear out, all the aggregate variables like the labor force and the capital stock[1] in the country are constant over time.

The Two Factor Case

If, in the sort of long run model just postulated, there are only two

[1] This assumption is consistent with a situation in which the typical individual ends his life with the same capital stock as he started it. One can assume that there is no bequeathing, in which case individuals will usually save during periods when their incomes are high and dissave in the latter part of their lives. The same sort of relationship between the lifetime pattern of income and that of consumption would presumably hold also where each individual received a bequest from his parents and passed the same amount on to his children. One must make one of these two assumptions of the system would not be a stationary one.

factors, and emigrants do not retain investments in the country after departing, it is the relative savings propensities of the emigrants and non-emigrants which play the role taken in the short-run case by the relative amounts of capital held. The result is analogous; whenever the average saving propensity of the emigrants is different from that of the non-emigrants, then the latter lose as a result of the emigration. Assume that there is no bequeathing so that saving is done only in order to redistribute the pattern of an individual's consumption over his life. If a group does no saving at all, it has an over-life consumption pattern identical to its income pattern. A group which saves has a different pattern of income and consumption. During the early working years, income is greater than consumption so that net saving is taking place. During the last years of life dissaving occurs.[1]

An above average savings propensity means that with a given interest rate an individual saves more than the representative individual during his life and by implication, in the case when no bequeathing occurs, dissaves faster during the latter part of his life.[2] The absolute amount saved depends on the marginal efficiency of capital, the greater the rate of return on savings in terms of increased consumption at a later time, the greater will usually be the total amount of saving done.[3] Thus this case differs from the short run case in that savings (and hence capital formation) are linked to the rate

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[1]It is assumed that net domestic savings finances investment in real capital in the economy (and not in other countries) so that the total capital stock at any given time is equal to the total of all net savings to date.

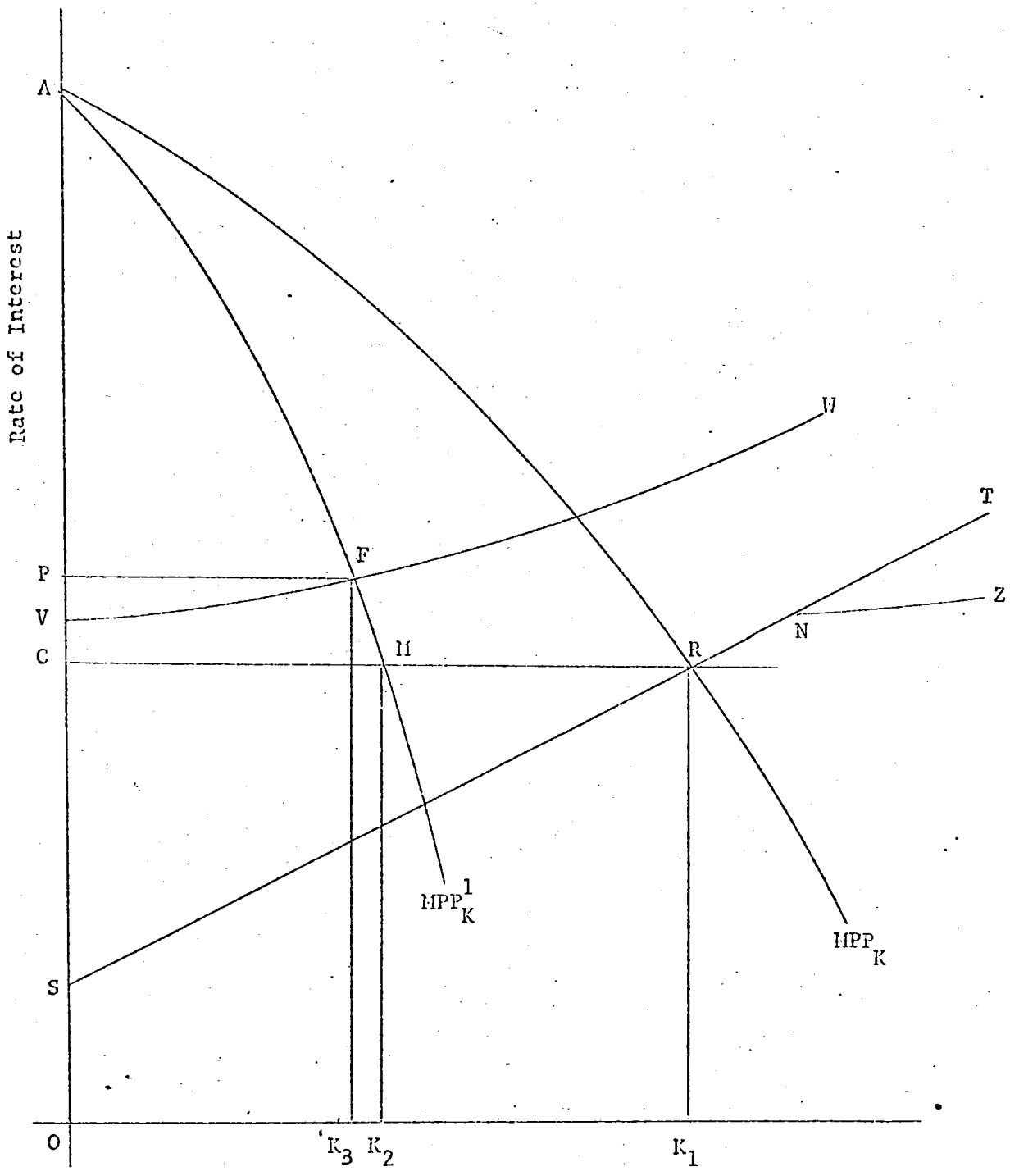
[2]If bequeathing is done for the economy as a whole, a high savings propensity would be reflected in a high equilibrium level of wealth given the rate of interest.

[3]It is true, of course, that there is an income effect as well as a price effect of the changes in the rate of interest; however, the case where savings are a decreasing function of the rate of interest is not treated here.

of interest so that the capital a person holds is not given exogenously but rather depends on market forces. It is still possible, however, to distinguish high and low savers or capital holders, even when the amounts of capital are not fixed.

Suppose that the economy is made up of two equally large sets of individuals, one of which has a high savings tendency and the other a low one. In all other respects they are the same. Consider Figure 2 . MPP_K is the marginal physical productivity of capital curve. ST is the supply curve of loanable funds (or what might be called the "willingness to hold wealth") from the group with the high propensity to save and VW isthe corresponding curve of the low savers. The equilibrium capital stock is OK_1 and the equilibrium rate of interest is OC . The total returns to capital are given by the area designated by $OCRK_1$, while the rest of the area under the marginal physical productivity of capital curve corresponds to the remuneration of labor.

Now assume, to take a simple case, that all of the high savers emigrate. Since the curve VW has an intercept above C , the non-emigrants did no saving at all before the emigration. Now with one half of the labor having emigrated, the new marginal physical productivity of capital curve can be designated by MPP'_K . The precise relationship between this curve and the original marginal physical productivity of capital curve depends on the production function; however, given the assumption of constant returns to scale, it is obvious that if the amount of capital stock were one half of OK_1 , i.e., OK_2 , then the total product of the economy would be one half of its original level. Hence, the area above the line CR and beneath the curve


A
Rate of Interest
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P
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C
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R
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Z
S
MPP_K^1
MPP_K
O
K_3
K_2
K_1
Quantity of Capital

Figure 2

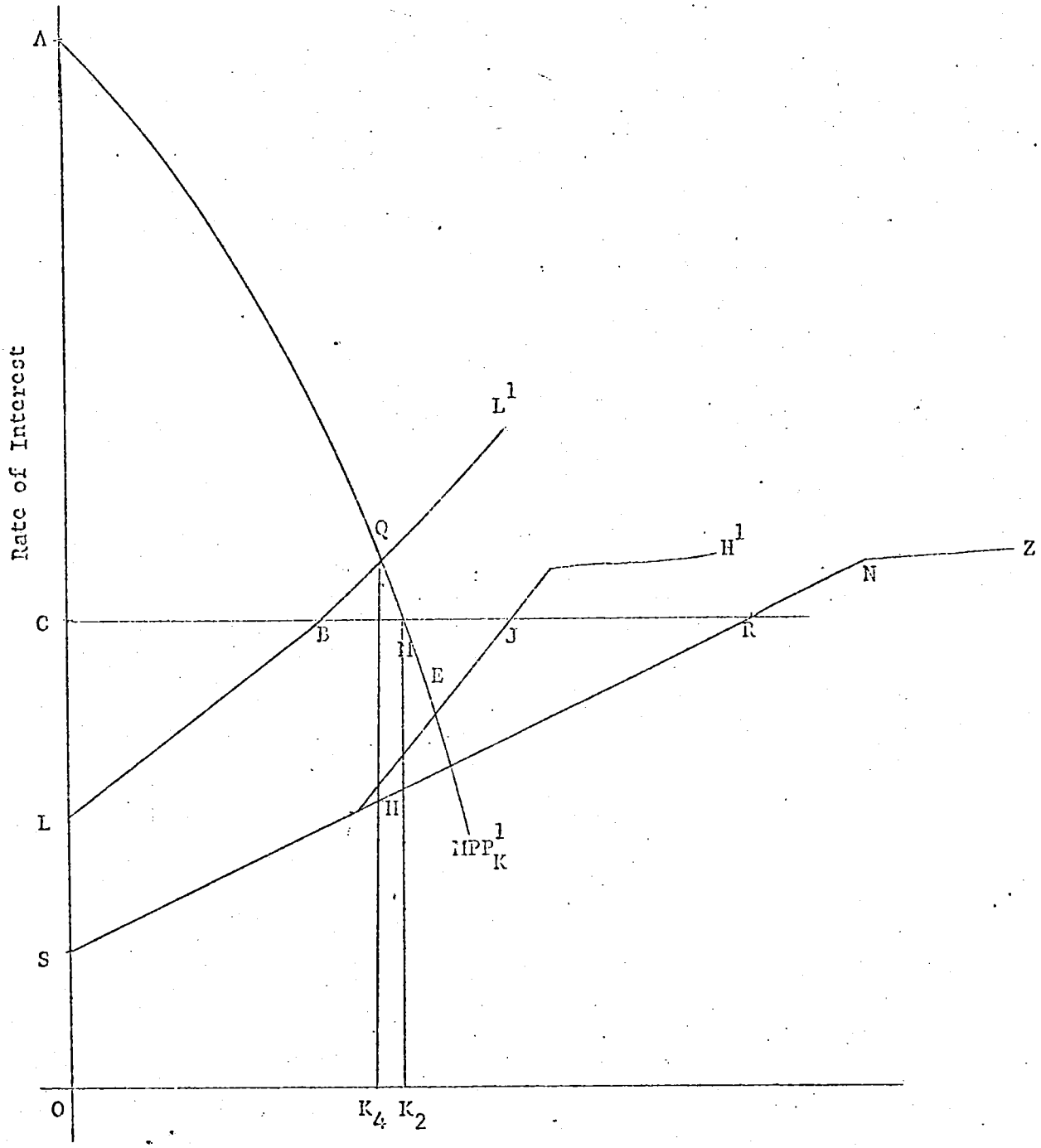
$MPP_{K'}$, (CAM) would be one-half of the area CAR . In fact, the capital stock will be less than OK_2 since at the rate of interest OC the people currently living in the country do not save at all. The equilibrium capital stock is determined by the point at which VW crosses the new marginal physical productivity of capital curve, i.e., the point F . Hence the equilibrium capital stock is given by OK_3 . Total income in the economy is now given by the area $OAFK_3$. The amount accruing to the non-emigrants in the form of wage payments is given by AFP . The return to capital is given by $OPFK_3$.

Compare, now, the level of welfare of the non-emigrants before the emigration and after it. The payment received before the migration is given by the area CAM and the payment accruing afterwards by $OAFK_3$. Superficially, it appears that the welfare level is greater in the latter case, but such a comparison fails to take account of the fact that the non-emigrants, in order to maintain the capital stock OK_3 , have had to change the time pattern of their consumption from what it was before. Each individual now saves during the early part of his income earning life and runs down his assets during the later part of his life. In the pre-emigration economy, with a rate of interest given by OC , this set of individuals did no saving but preferred to consume currently their total income of CAM . Part of the increased income which they receive in the second case is a payment necessary to persuade them to save during the early part of their lives and dissave during the latter part, rather than consume their current income throughout their lives. The amount of this payment can be shown diagrammatically by the area area $OVFK_3$. It is the amount by which the asset-holders in the economy

feel themselves to be worse off when they have to hold assets (i.e., postpone consumption) for one more period. In the original case such postponing never occurred; hence it is necessary to subtract out this amount ($OVFK_3$) from the total income accruing to the non-emigrants before making the comparison with the pre-migration income. The area which must be compared with CAM is VAF which is clearly the smaller of the two. Hence, the non-emigrants are in a worse position than they were before the emigration occurred.

To distinguish between this adjusted income level and the unadjusted one, we henceforth designated the former as "permanent income."

Figure 2 simply illustrates the general proposition that whenever the emigrants have an average savings tendency different from that of the non-emigrants, then the non-emigrants are worse off than before. This proposition is further clarified in Figure 3, which differs from Figure 2 only in that varying savings propensities on the part of the emigrants and non-emigrants are considered. SNZ , the total supply curve of loanable funds is, however, held fixed. Let the supply curve of loanable funds for "low savers" be LL' and let it cut the line CR so that at the interest rate OC the low savers supply an amount of funds CB . The supply curve of the high savers can be derived as the horizontal distance between SZ and LL' , i.e., SHH' . Our welfare measure for the low savers before any emigration occurs is now ACM + LCB and for the high savers ACM + SCJ . If the high savers emigrate, the "welfare" of the low savers would become LAQ with an equilibrium capital stock of OK_4 . This is lower than the pre-emigration income by the area BQM . If the low savers emigrate, the income of the high savers who would then be left would become SAE , less than the original income by MJE . It is


A
Rate of Interest
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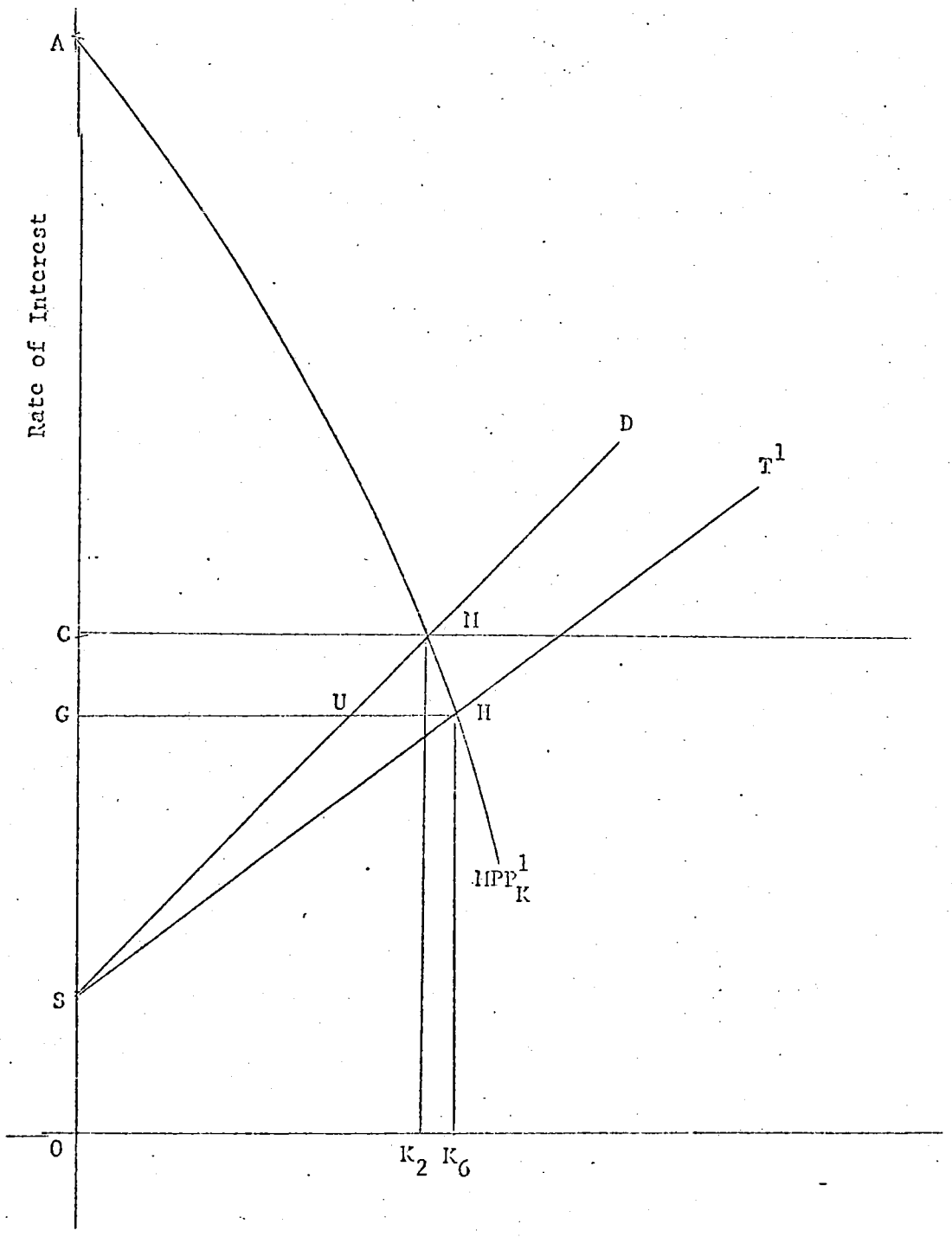
MPP_K^1
S
O
K_4 K_2
Quantity of Capital

Figure 3

clear that the non-emigrants lose in all possible cases except when LL' and SHH' coincide (at least at the interest rate OC); but this is precisely the case in which they do have the same savings propensities.

Thus far we have assumed that emigrants have done what is equivalent to taking their capital with them, i.e., they have not retained investments in the country, but have sold them to non-emigrants, thus using up some of the savings of the latter group.

In the case where the two groups have the same savings propensities and the emigrants do not take their physical capital with them, the non-emigrants may be benefited by the emigration. The capital left in the country by the emigrants increases the capital-labor ratio and reduces its own rate of return. The situation is illustrated in Figure 4. One-half of the population has emigrated and the marginal phusical productivity of capital curve and lettering are those of Figure 3. The supply curve of loanable funds of the non-emigrants is given by the line SD , which cuts the marginal physical productivity curve at the point M due to the assumption that the tendency to save is the same for emigrants and non-emigrants. In other words, if none of the emigrants' capital had remained in the country the equilibrium rate of interest would have been at its original level of OC . The income of the non-emigrants, the sum of the wages which accrued to the non-emigrants before emigration, (CAM) and the gain from their contribution to the capital stock (SCM) would likewise have been at its original level. That some of the capital belonging to the emigrants remains in the country can be represented by the fact that the total supply curve of loanable funds ST' , will lie to the right of SD . The new equilibrium rate of interest is given by OG and the total wage bill accruing to the non-emigrants is now given by the area GAN. The net gain due to their contribution to the capital stock is now given by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Rate of Interest
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C
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U
H
MPP1K
S
0
K2
K0
Quantity of Capital

Figure 4

SGU . It is obvious that the latter income (SGU + GAN) is greater than the former (SCM + CAM) the difference being the area UMN .

Table 2 summarizes the conclusions in this long-run two-factor case.

The Two-Plus Factor Case: Different Labor Skills

Consider now the possibility that emigrants and non-emigrants may differ, not only with respect to savings propensities, but also with respect to skill levels. Unskilled labor can be transformed into skilled labor by educational investment. When the stationary dynamic model, which is the current framework of analysis, is in dynamic equilibrium, the only investment occurring in education is that required to offset depletions in the stock of skilled labor through retirement and death. If the assumptions made throughout the paper (internal factor mobility, perfect markets, etc.), are expanded to include perfect foresight and no risk aversion, the transformation of one type of labor into another by means of education would occur automatically up to the point where the benefits and costs accruing in the future, discounted by the rate of interest, would just equal the current costs of the educational process. Each individual would take care of his own education in such a way as to maximize his discounted income stream. What then would happen in this stationary economy if either a temporary or a continuing outflow of one type of labor occurs?

It can be shown that if emigrant and non-emigrant savings propensities are the same, and if unskilled labor is transformable at a constant cost into skilled labor, any emigration of either skilled or unskilled labor will not affect income per person for the non-emigrants as long as it is foreseen so that the time lag involved in education does not leave factor proportions different from their long-run equilibrium values. If skilled labor is

Table 2

The Two Factor Dynamic Stationary Case

R^1 Savings Propensity of Emigrants / Savings Propensity of Non-Emigrants	Emigrants Take Capital	Emigrants Leave Their Capital
$0 \leq R < 1$	Loss Increases	Gain Increases
$R = 1$	No change	
$R > 1$	Loss Increases	No change Loss Increases

1. R = Ratio of Savings Propensity of Emigrants to Savings Propensity of Non-Emigrants.

emigrating then the educational sector will have to be larger to make sure that even after the emigration the ratio of skilled labor to unskilled labor and to physical capital is the same as it would be in the absence of the migration. If unskilled labor emigrates, the educational sector will, conversely, have to be smaller.

If there are "increasing costs"[1] to educating higher and higher proportions of the population (or absolute numbers) to skilled levels, then emigration of skilled workers implies loss to the non-emigrants even in the long run; emigration of unskilled workers implies a gain. These results are reversed if there are decreasing costs in education.

Government Subsidies to Education

With free capital markets and no risk aversion, one would expect each individual to take care of his own education in such a way as to maximize his overall discounted productivity. Because individuals are risk averse or lack information, and capital markets are not perfect, it is usually believed that the amount of investment in education which would occur without any government assistance would be less than the optimal amount. As a result, the government intervenes, and gives educational subsidies.

Such a situation suggests in some sense that the loss to the remaining population as a result of emigration of skilled personnel will be greater

[1] In the present context, by increasing costs we mean to include not only the possibility that total costs may rise faster than the number of people educated because of decreasing returns to the industry with the innate quality of students constant (a rather implausible event) but also that as more and more people are educated, the additional students are less and less suitable and hence do not gain as much from a given level of educational cost.

than it was in the preceding analysis. The emigration of an individual who has borne his own educational expenses is one thing; whatever decrease in consumption had to be sustained in order that he be educated was borne by himself. However, when a subsidy policy is in effect the decrease in consumption which finances the investment in education is borne to a large degree by the population which will remain after the emigrant leaves. This particular part of the loss to the remaining population is equal to the total government subsidy going into the education of the emigrants.

Interdependent Utility Functions

If each individual is thought of as a unit whose welfare is independent of that of every other individual, then the non-emigrant population as a whole loses a greater amount when the migrants' education has been subsidized than when this is not the case. Suppose, however, that the members of a particular family tend to think of their welfare as a whole. The parents are happier if the children are well off. In this case if a father pays for the education of his son, the father may not feel any worse off if the son eventually emigrates than he would if the son remained in his own country. Whether the father pays for the education of his son directly, or indirectly through a tax and benefits system via the government, makes no real difference. As long as the distribution of benefits from public education is proportional to the taxes which result from the need to make these expenditures, the families of the non-emigrants are in essence paying for the education of their children and the families of the emigrants are paying for the education of their children. Clearly, then, the families

of the non-emigrants are not hurt by the migration since they have not in fact helped to pay for the education of the emigrants' children. Similarly, the families of the emigrants have not lost, since by assumption, they would be just as happy to have their children educated and then leave the country as to have them educated and stay in it. In this case there is no "subsidization" loss from migration.[1]

The same conclusion holds even when, as a result of the emigration, the government increases the number of children receiving education. The non-emigrants continue to pay a proportion of the total educational bill equal to the per cent of all students being educated who are from their families. Although the total tax bill for purposes of education is higher for the non-emigrants than before, more of their children are being educated. These two factors just offset each other.[2] To the extent, of course, that the extra children who have to be educated as a result of the departure of the emigrants are less suited than the ones educated first, the economy as a whole suffers a loss. This loss possibility has already been considered (increasing costs of education); there is no added loss as

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[1]It must be borne in mind that there may be loss due to changed factor proportions, different savings propensities, etc., but that we are here concerned only with whether there is a further loss due to government subsidization.

[2]We assume that the government is, as before, ensuring that optimal number of children be educated. It is probable that the non-emigrants would be unwilling to increase their savings (either directly or through taxes paid to the government) sufficiently to maintain the same factor proportions(among physical capital, skilled labor and unskilled labor) as before. This fact has its own welfare implications, i.e., those already discussed above. The "effective rate" of savings of the group of families whose children emigrate will be decreased by the emigration inasmuch as this human capital is lost to the economy, so that the families of the non-emigrants would gain or lose on this account according to whether their savings propensities were, respectively, higher or lower than that of the families of the emigrants.

a result of the fact that government subsidies for education are a feature of the situation.

It is clear that in the analysis of this problem it is not safe to use the assumption of an independent utility function for each individual. If one assumes that parents receive an increase in utility sufficient to compensate them for the costs of educating their children, then the conclusion that government educational subsidies to people who emigrate result in a loss to the remaining population is not valid. The problem clearly cannot be solved by the use of economic theory. The implications of the two types of utility functions on the part of the emigrants' families are different with respect to the optimal government educational strategy in a situation where emigration is likely to occur. When the families of the emigrants are paying (in a sense voluntarily) for the education of their children with the government acting as an intermediary (and one form of labor is transformable into another at constant costs), then the implications for governmental policy are fairly straightforward. There is no loss to non-emigrants through subsidies to emigrants no matter how large the educational sector in the country is or how many people emigrate, (assuming that the government acts with foresight so that it is never caught off-guard by a sudden wave of emigrants).

Independent Utility Functions

The implications for government policy are considerably more complicated when the opposite extreme assumption is made; namely, that the families of the emigrants are just as unwilling to pay for the education of their children as are the families of non-emigrants. Under these assumptions and given the possibility of emigration, it may not pay the government to give as large

subsidies as in a situation where emigration does not occur; or conversely, it may pay the government to educate more people.

To make this analysis a little more precise, assume that the emigration occurs in response to a wage differential between the country in question and countries to which the emigrants go. The probability that any one individual will emigrate can be assumed to be an increasing function of this differential. Suppose the optimal annual production of skilled manpower under the assumption of no emigration is known. Now if emigration occurs and the government continues to subsidize students to the same extent as before, the number remaining in the country will decrease. The stock of skilled manpower in the country will become constant at some equilibrium level smaller than in the closed economy; hence the wage will be higher. The training of another worker would clearly pay off if the government could be sure that he would stay in the country, since the marginal productivity of this type of labor is now higher than it was in the closed economy and the costs of training are presumably the same.[1] But if he emigrates early in life then the investment in him is thought of by the government as being lost. Whether the

[1]It is assumed that the government is interested in maximizing the total income of everyone in the economy. Thus, for education to pay off it is not necessary that it pay off for anyone but the individual on whom the expenditure is incurred. So the sense in which an investment does not pay off if the individual emigrates is simply that with his emigration the government's interest in him suddenly disappears. This may appear to be a rather strange concept but it is implicit in the assumptions which have been made above. The government is concerned only with the set of individuals in the country at a point in time, and in discounting future income it concerns itself only with the set of individuals in the country at each given point in the future. So the improvement in the welfare of any individual is counted only as long as he remains in the country.

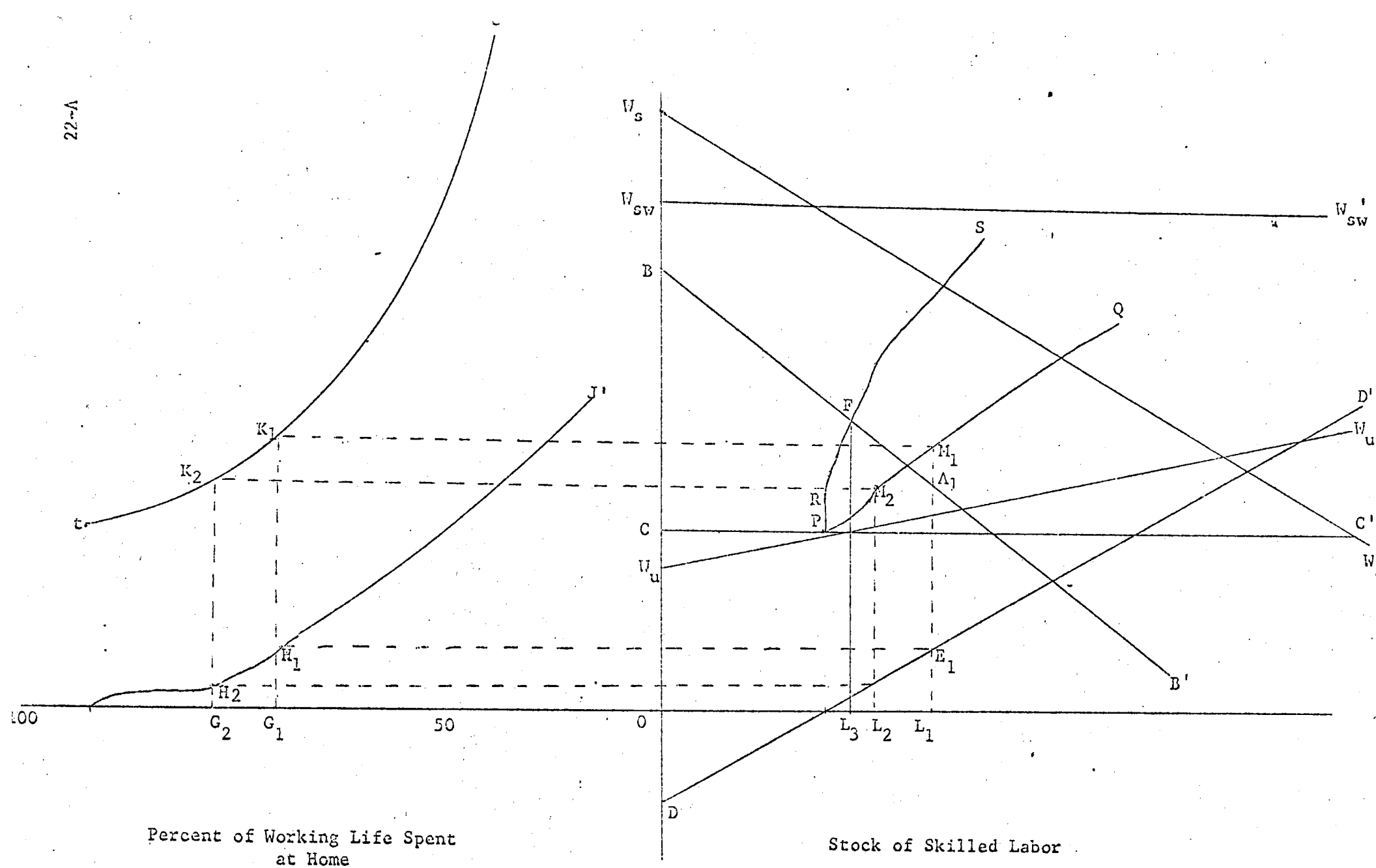
government should now undertake a more or less rapid production of high-skilled labor than in the closed economy depends on the way in which the probability that a worker will emigrate from the country depends on the wage he receives in the country.

The relevant relationships are illustrated diagramatically in Figure 5. On the right side the stock of skilled labor in the economy is measured on the horizontal axis. The line, CC' , gives the total cost per unit of skilled labor educated as a function of the stock of skilled labor. The benefits, measured as the difference between the wage streams for skilled and unskilled labor over the working life of the individual, discounted to present value, are also a function of the stock of skilled labor,[1] and the line BB' gives the benefit resulting from the addition of one more skilled laborer. The line W_sW_s' gives the wage rate of skilled labor as a function of its stock and the line W_uW_u' gives the wage of unskilled labor as a function of the stock of skilled labor. BB' is derived as the vertical distance between these two lines. It has a negative slope. The intersection of CC' and BB' at point F gives the optimal stock of labor in an economy from which there is no emigration.

The height of the line $W_{sw}W_{sw}'$ gives the world wage rate for skilled labor. The distance between BB and $W_{sw}W_{sw}'$ (given by the curve DD) represents the difference between the world and domestic skilled labor wage rates as a function of the domestic stock of skilled labor.

In the left half of Figure 5 the curve JJ' relates the percent of

[1]Alternatively, both costs and benefits could be measured in terms of weeks or months, with the cost then being that weekly or monthly amount which if it had to be paid over the individual's working life and were discounted to present value would just equal the actual cost of the education.



Percent of Working Life Spent at Home

Stock of Skilled Labor

Figure 5

working life spent in the country of origin, measured on the horizontal axis, to the wage differential, measured on the vertical axis. The larger the wage differential, the greater is the likelihood of emigration for the representative worker and/or the greater percentage of his working life will be spent outside the country. It is assumed that when the domestic and foreign wage rates are equal individuals will spend their whole working life in their country of origin.

The curve tt relates the percent of working life spent at home to the average cost of the stock of skilled labor in terms of educational expenditures. If there is no migration (the per cent of working life spent at home is 100), the average cost of maintaining a stock of skilled labor is given by OC. However if the representative person educated spends only 50 per cent of his working life in the country, then the average cost of the stock of skilled labor is twice OC.

It is now possible to show how the stock of skilled labor is related to the average cost per unit educated. If the stock is OL_1, then the domestic wage differential between skilled and unskilled labor is given by L_1A_1, and the differential between the domestic and world wages for skilled labor by L_1E_1, also equal (by construction) to G_1H_1. The per cent of working life spent at home is given by OG_1. The average cost of the stock of skilled labor given that the per cent of working life spent at home is OG_1, is equal to G_1K_1 or equivalently L_1M_1. A similar procedure for the stock OL_2 yields an average cost of L_2M_2. The locus of such points gives an average cost curve in the presence of possible emigration as defined by the curve JJ'. This curve is given by CPM_2M_1Q.

Under the extreme assumption that the government has to pay the full

cost of education, the optimal capital stock can be deduced from the point at which the BB' line intersects the curve marginal to the average cost curve M_2M_1Q . The marginal curve is given by CPRS , so the equilibrium stock would be OL_3 . The optimal capital stock is, as one would expect, smaller than it would be if emigration were not a possibility. The number of people being educated may be greater or less than in the no emigration case.

In a situation where there is no emigration the optimal amount of education is the same whether there is no risk aversion or imperfection of capital markets (so that individuals can pay for their own education) or whether there are such imperfections and the government is required to make the payments. Where government subsidies are required but are only partial payments of the total cost of education, it is still correct to represent the benefits curve by BB , but the marginal costs and average costs to the non-emigrants can no longer be represented as they are here. Suppose, for example, that the emigrant pays 50 per cent of the costs of his education and the rest is met by government subsidy. Then the height of the average cost curve per unit of stock of skilled labor is equal to the vertical distance OC (representing the full educational cost of an individual who does stay in the country) plus 50 per cent of the addition to the average cost per unit stock retained in the country resulting from the fact that some emigrate. Hence, the average cost curve in this situation would be the CC curve to the right as far as the point P and then would be one-half as much above the CC curve as is our original average cost curve $M_2M_1Q_1$. The relevant marginal cost curve would be marginal to this newly defined average cost curve. The equilibrium amount of education would

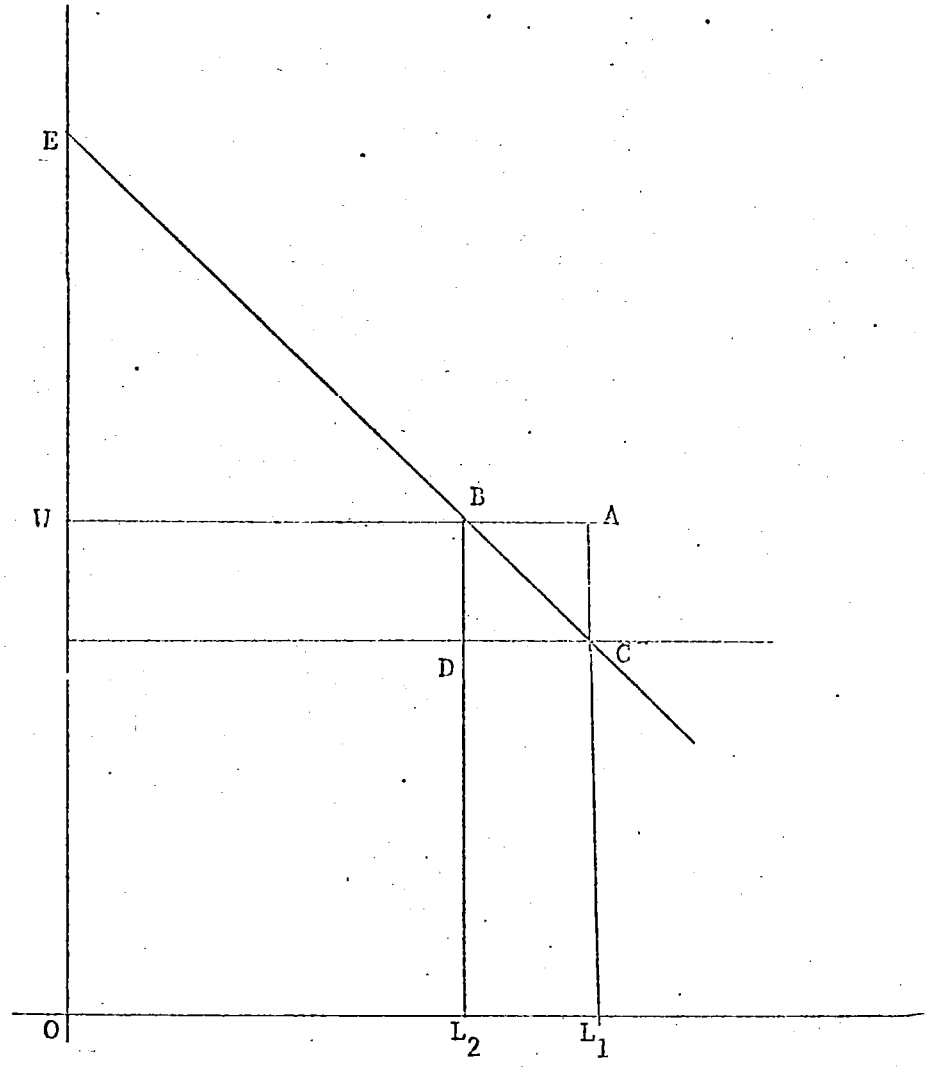
clearly be larger in the situation where a larger proportion of the cost is borne by the individual receiving the education.

Government Wage Policies

An alternative to a policy of subsidies to education as a means of maintaining a desired stock of skilled labor is a policy of subsidizing wages, which would reduce emigration of a given type of skilled labor by reducing, for that type of labor, the wage differential between this country and the rest of the world. Such a policy never pays in the short run. This proposition is illustrated in Figure 6 (which corresponds to Figure 1) where the loss to the non-emigrants from the departure of L_1L_2 workers is measured by the triangle BCD . The amount which non-migrants would have to pay to all of these potential migrants to persuade them to remain in the country is given by the rectangular area ACBD . Since the area of ACBD is greater than the area of the triangle BCD , the policy would cost the non-emigrants more than they would gain by having the emigrants remain.

The conclusion derived in the short run static case does not always hold in the dynamic case where there are government subsidies to education. Figure 7, of the same general format as Figure 5, shows how the wage subsidy policy could benefit the non-emigrants. Assume that the government already has an optimal education sibsidy policy, as defined in Figure 5, and as a result, the stock of skilled labor is OL_3 . Without asking whether it is an optimal policy we arbitrarily assume the government subsidizes wages of skilled labor by an amount DD_s .[1] This shifts the wage differential curve DD' downwards to D_sD_s' . The original average cost and marginal

[1]It would be possible to discuss the choice of the optimal wage subsidy but we are here concerned only with showing that some subsidies can be beneficial.



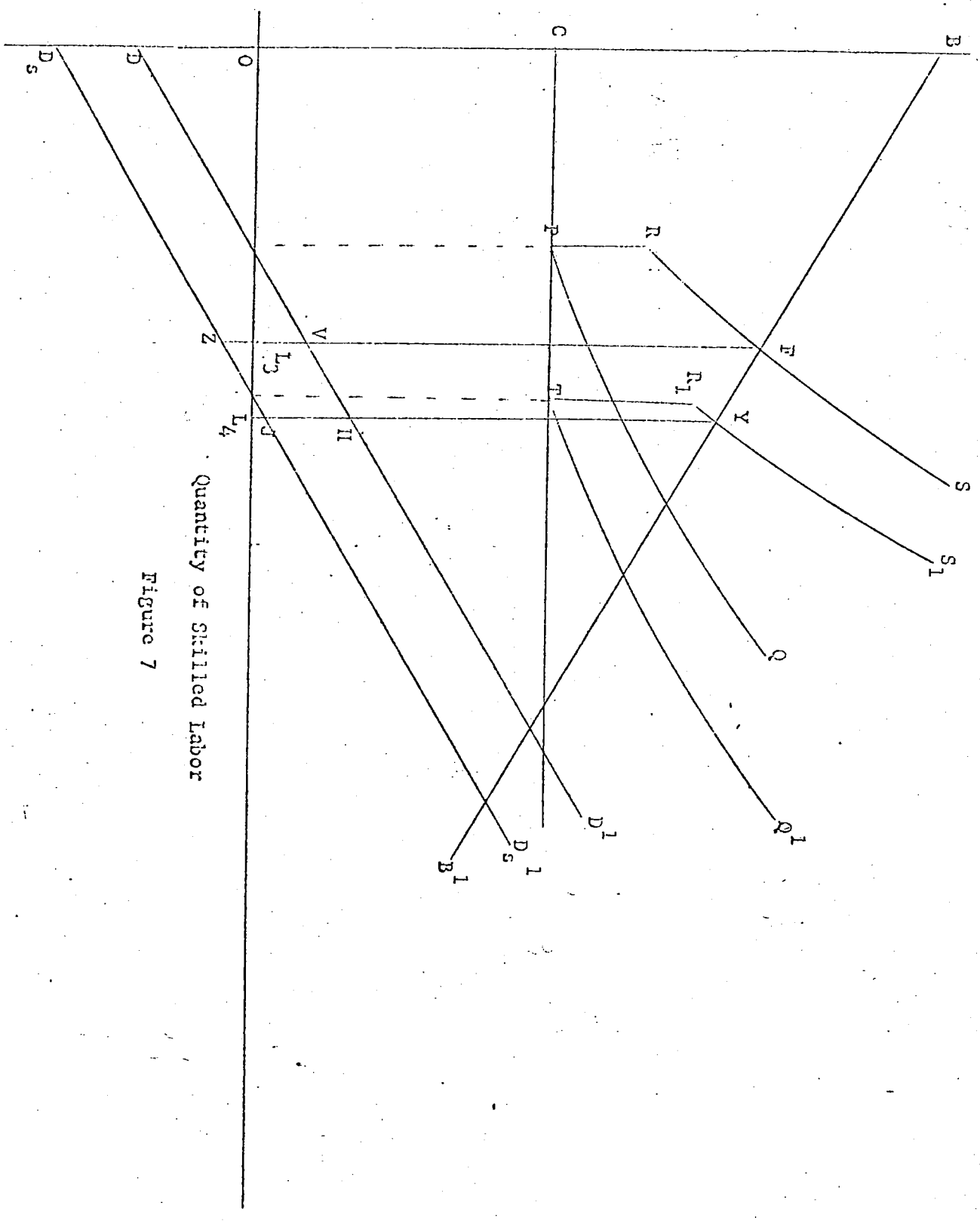
Quantity of Skilled Labor

Figure 6

cost curves of the skilled labor stock are CPQ and CPRS . The new ones, are represented by CTQ' and CTR_1S respectively. By following through the logic illustrated in Figure 5, one can see that the new average cost curve CTQ' is to the right of the original by the horizontal distance between DD' and D_sD_s' . The total subsidy which is paid to skilled laborers is $DHJD_s$, but only VHJZ is a payment from non-emigrants to people who would have emigrated in the absence of the policy. The net contribution of skilled labor to the economy was originally EFRPC and is now BYR_1TC , having thus increased by FYR_1TPR . In our diagram this gain is clearly much larger than the cost.

Implications of Emigration in a Growing Economy

Until now we have been concerned either with a static or short-run economy in which there is no adjustment of factor proportions except that resulting directly from migration; or, with a stationary dynamic economy in which either infinite time is available for the system to readjust to shocks or where all exogenous changes are foreseen and planned for. It is clear that neither of these two systems is the relevant one for the analysis of most countries and that in order to get a more appropriate answer to the questions we are asking we must have a growing system. The previous systems have been used basically because they give a simpler base from which to analyze some of the questions and because the results are essentially the same in the growing economy. Any emigration will lead in the short run to the static type loss discussed earlier in this paper and will set up the reaction pattern we discussed in the dynamic stationary system.



Quantity of Skilled Labor

Figure 7

One might expect that, in a growing economy, the departure of people with low savings rates would benefit the non-emigrants in a long run sense, even though there might be the usual short run loss. But consider what happens in this case. The rate of return to capital formation will decrease since, because the non-emigrants had a higher savings ratio than the emigrants, the ratio of labor to capital will now be lower than it would have been had the emigration not occurred and the marginal productivity of any given amount of capital will be lower. We know from our earlier analysis of the dynamic stationary economy that the increase in wages of the non-emigrants is insufficient to offset the decrease in non-wage incomes. This initial decrease in income is felt also in the growing economy and coupled with it is a decrease in the return to savings, which will probably lower the rate of capital formation of the non-emigrants below what it would have had the emigration not occurred. It is true, of course, that the average growth rate of the economy as a whole will probably be higher after the emigration than before it; but this is just another example of the apparent paradox first referred to in our short-run analysis above (see page). If the emigration had not occurred, the non-emigrants would have gained even faster than they now gain, while the emigrants, having a lower income per capita would have kept the average income per capita down below what it currently is, and would have had a more slowly growing income level.[1]

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[1]It is interesting to ask how our results would be affected if we allowed for embodied technical change. If the rate of technological progress was an increasing function of total investment in the economy as a whole, it too would be decreased by the emigration, since total investment would be decreased. If, however, the rate of technological progress depended positively on such a variable as the capital-labor ratio, our results could be reversed.