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LABOUR MIGRATION AS A RESPONSE TO RELATIVE DEPRIVATION

by

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ABSTRACT

In this paper we define the relative deprivation of a person with income y as an increasing function of the percentage of individuals in the person's reference group whose income is larger than y. We obtain his satisfaction by adding up the marginal utilities of income over the range of income a person possesses. We model migration from one reference group to another as a response to relative deprivation and satisfaction: We say that a strong incentive to migrate exists if relative deprivation decreases while satisfaction rises with migration and that a weak incentive exists if the individual increases or decreases his satisfaction and deprivation at the same time by migrating. We derive conditions under which different incentives, weak or strong, hold for different individuals. We obtain the result that in general the richest individual in a society will not have a strong incentive to migrate but may have a weak incentive to migrate, whereas the poorest individual may have a strong incentive to migrate and also a weak incentive to migrate. Our analysis enables us to explain several perplexing migratory phenomena, identify income inequality as a distinct explanatory variable of migration and establish an incentive to migrate in situations where the utility-social welfare approach does not.

I. Relative Deprivation: The Basic Approach

The theory of relative deprivation is a theory about the feelings raised by social inequalities. The original conceptualization of the theory appears in the famous three-volume research monograph The American Soldier: Adjustment During Army Life, (1949). The theory has been applied to several fields in order to model social behavior. (See Crosby (1979) for an excellent review.) However, as pointed out by Merton and Kitt (1950), the concept of relative deprivation is not formally defined in The American Soldier. Therefore it is not surprising that Crosby (1979) counts four versions of the theory and that in general there is no agreement on what is the exact meaning of the term relative deprivation. In this paper we follow the approach developed in Yitzhaki (1979, 1982) and Stark (1984a, 1984b) which may be viewed as the economist's interpretation and quantification of the work of Runciman (1966). Runciman defines four conditions for an individual to feel relatively deprived: "We can roughly say that [a person] is relatively deprived of X when (i) he does not have X, (ii) he sees some other person or persons (possibly including himself at some previous or future time) as having X (whether or not that is or will be in fact the case), (iii) he wants X, and (iv) he sees it as feasible that he should have X." (Runciman (1966), p. 10).

The relativity of the concept is due to (ii) and (iv). The feeling of deprivation is defined by (i) and (iii). Replacing (i) with (i') "the person has X", where X represents a bundle of commodities x, enables us to interpret (i') as representing the utility or disutility derived from x, while (iii) eliminates disutility and thereby ensures utility. An individual's utility is a function of the commodities he has, whereas deprivation is the loss in forgone utility, due to not having commodities. Obviously, having x also means not having more than x or being deprived of having more than x. Formally, if u(x) is an index of the satisfaction from having x then -u(x) can serve as an index of the deprivation of having no more than x. Maximizing u(x) subject to an income constraint yields the same result as minimizing deprivation, -u(x), subject to the same constraint. Hence we can argue that the deprivation concept and the utility concept are two sides of the same coin; whereas utility is defined on "having," deprivation is defined on "not having."

However, there are two major differences between a relative deprivation approach and the utility, or the welfare function, approach. One, related to the relativity of the concept, emerges from the existence of reference groups in the society. How reference groups are formed and dissolved is a complicated issue that we hope to explore in the future. For the moment, we assume that the entire society constitutes the reference group and later on, when modeling migratory behavior, that society consists of two such groups. This assumption simplifies the presentation at the cost of ignoring an important dimension of the relative deprivation approach.

The other major difference between the relative deprivation approach and the welfare function approach relates to the marginal utility of income. Under the utility approach, the marginal utility of income is a function of income alone and hence does not depend on the income of others. Under the relative deprivation approach, each unit of income can be viewed as Runciman's x, and the feeling of deprivation which arises from not having the unit is an increasing function of the number of individuals in the reference group who have it.[1] Note, however, that envy or altruism are not postulated; what counts is how individuals evaluate what they have (satisfaction) and what they do not have (deprivation).

Assume a continuous income distribution. Then, each income unit (Runciman's x) is represented by an income range $[y, y+\Delta y]$ where $\Delta y \to 0$. Let $F(y)$ be the cumulative distribution of income. Then $1-F(y)$ is the percentage of individuals whose income is higher than y. Hence $1-F(y)$ represents the percentage of individuals who have the commodities represented by the income range $[y, y+\Delta y]$ and the feeling of deprivation is an increasing function of the percentage of individuals who have income larger than y, i.e., $1-F(y)$.

Let $h(1-F(y))$ be the deprivation from not having $[y,y+\Delta y]$, where $h(0) = 0$ and $h' > 0$. Then an individual whose income is y is deprived of all units of income above y. Thus we can write:[2]

$$D(y) = \int_y^{\infty} h[1-F(z)]dz \qquad (1)$$

In order to simplify the discussion, we shall assume for now a simple form of $h[1-F(y)] = 1-F(y)$. In Section III we return to the more general form $h(\cdot)$.[3]

The deprivation function is defined on "not having." But it might be more convenient to work with a concept defined on "having." It is fairly easy to obtain such a concept by adding up the marginal utilities of income on the range of income that the individual possesses. We call this function the satisfaction function (the gratification function). Formally,

$$S(y) = \int_0^{y} h[1-F(z)]dz \qquad (2)$$

which, given our assumption on the form of h, becomes:

$$S(y) = \int_0^{y} [1-F(z)]dz \qquad (3)$$

The satisfaction and the deprivation functions complement each other in the following manner:

$$D(y) + S(y) = \mu \tag{4}$$

where μ is mean income.[4] Hence in evaluating a change in the well-being of an individual in a given reference group, it does not matter which function is used. However, once we bring in migration, since the individual moves from one reference group to another, it may well happen that satisfaction and deprivation increase or decrease in tandem.

We now briefly note the main properties of the functions.

a. $\frac{\partial S}{\partial y} = [1-F(y)] \geq 0$; $\frac{\partial^2 S}{\partial y^2} = -f(y) \leq 0$, that is, the marginal satisfaction is non-negative and non-increasing. Intuitively, the individual will be more satisfied the more valued are the commodities he possesses. This value is an increasing function of 1-F(y), the fraction of individuals in the reference group who possess these commodities. In a society in which possessing a car is uniformly desirable, having a car is more valuable to an individual when many individuals possess cars than when only few do.

b. An increase in the income of a person who is poorer than the individual, such that the individual's rank remains intact, increases satisfaction but does not affect deprivation.

c. An increase in the income of someone richer than the individual does not affect the individual's satisfaction, but it increases his deprivation.

d. The deprivation of an individual can be written as the percentage of persons who are richer than the individual times their mean excess income, that is:

$D(y) = [1-F(y)]\ E(z-y|z>y)$ where z is the income of the richer persons.[5] Hence, for a given mean excess income of persons richer than the individual, the individual's deprivation is an increasing function of the percentage of such persons; and for a given percentage of persons richer than the individual, the individual's deprivation is higher the larger is their mean excess income.

e. The satisfaction of an individual can be written as:[6]

$$S(y) = \mu\left[\frac{\partial \phi(F)}{\partial F(y)}\,(1-F(y)) + \phi(F)\right] \qquad (5)$$

and his deprivation as:

$$D(y) = \mu[1-\phi(F) - \frac{\partial \phi}{\partial F}[1-F(y)]] \qquad (6)$$

where, as before, F is the cumulative distribution function, that is, the rank of the individual in the society, $\phi(F)$ is the Lorenz curve, that is, the percentage of total income received by individuals with incomes lower than that of the individual and $\frac{\partial \phi}{\partial F}$ is the slope of the Lorenz curve. It is worth noting that $\frac{\partial \phi}{\partial F} = \frac{y}{\mu}$, that is, the income divided by the mean.

Using the absolute Lorenz curve,[7] that is, the Lorenz curve where incomes are <u>not</u> divided by mean income, enables us to portray S(y) and D(y) graphically as in Figure 1.

OAB is the absolute Lorenz curve. The curve passes through (0,0) and $(1,\mu)$; it is convex and its slope is equal to y. The line AC is tangent to the Lorenz curve at $F(y^*)$. Hence, BC is the deprivation of an individual with income y^* whereas CD is his satisfaction. To obtain this note that $CE = y^*[1-F(y^*)]$ and thus $CD = y^*[1-F(y^*)] + \mu\phi[F(y^*)]$ which upon rearrangement gives (5). Equation (6) can be derived geometrically in a symmetrical manner.

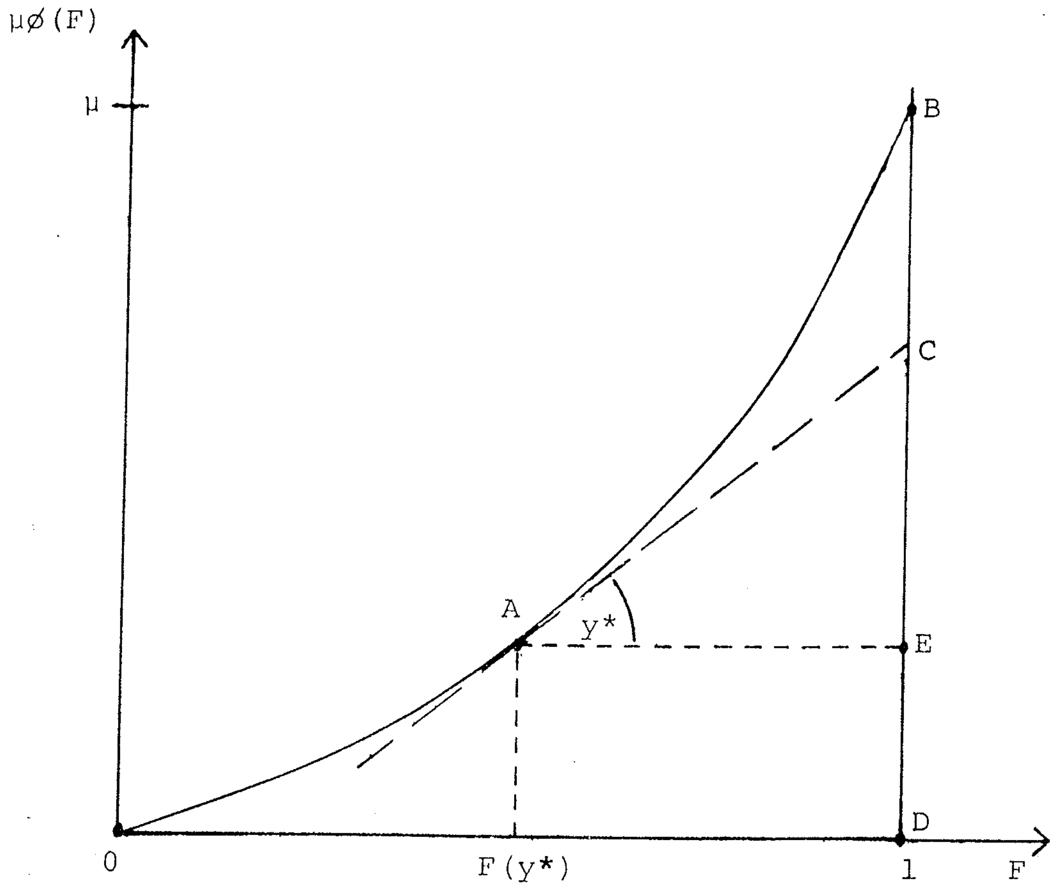

FIGURE 1

A Diagrammatic Presentation of Deprivation and Satisfaction

II. Deprivation and Migration

An individual who feels deprived in his own community has an incentive to migrate. This incentive is inversely correlated with the possibilities for deprivation reduction through intra-community mobility. Of course, actual migration is a function of other considerations such as incurred costs, whether pecuniary or psychic, opportunities for migration and attitudes toward risk (risk aversion). Our objective in this section is to examine the migration predictions of the pure relative deprivation theory. Since other variables are ignored, the discussion is restricted to whether a relative deprivation incentive to migrate exists and if so whether it is strong or weak. (We define these magnitudes below.) The predictions of the relative deprivation theory may be compared to the predictions of the utility theory, which are closely linked with those of the human capital approach. The prediction of the latter theory is fairly simple; an incentive to migrate exists if thereby expected lifetime income, appropriately discounted and netted, increases. Since the time dimension is fully and smoothly captured through the discounting procedure, there is no need to distinguish between short-run and long-run considerations.

However, in the case of a deprivation theory it is crucial to differentiate between the short run and the long run. In the short run the migrating individual probably continues to associate himself with his origin reference group. In this case, an individual will have an incentive to migrate only if his income increases, a conclusion which replicates the prediction of the utility theory/human capital approach.

In the long run, though, the migrating individual presumably associates with his new society, and refers to it as his new reference group.

In real life there is presumably a medium-run in between, wherein the individual may associate himself simultaneously with two reference groups, although not necessarily attaching the same weight to each. The passage from the short-run to the long-run may indeed be characterized by a gradual reduction in the weight attached to the origin reference group and a corresponding increase in the weight attached to the reference group at destination. The current paper deals only with a situation in which migration is accompanied by a complete (perfect) substitution of the reference groups, i.e., the long-run. This is a departure from our focus in earlier work on relative deprivation and migration (Stark 1984a, 1984b).

Since the society a migrant leaves and the the society he joins are different, it may happen that a migrating individual feels less deprived but also less satisfied in his new society or more satisfied yet more deprived. He feels more deprived if in the new society others have more goods than he does and more satisfied if he has more goods than before. Unless we explicitly model tastes, in such a case it is not clear which consideration dominates. We shall say that in situations of this type there is a weak incentive to migrate. That is, a weak incentive to migrate exists if by migrating the individual increases or decreases his satisfaction and deprivation at the same time. The implication of this condition is that it may then happen that some individuals will be motivated to migrate. We shall say that a strong incentive to migrate prevails if by migrating satisfaction increases and deprivation decreases. Then, migration is more likely, i.e., likelier than when the incentive to migrate is weak.

Thus, an individual who considers migrating from society A to society B has a strong incentive to migrate if $D_B < D_A$ and $S_B > S_A$ where D,S are deprivation and satisfaction respectively. It is assumed that both societies are large, so that the effect of migration by an individual on the distribution of income by size in both societies can be ignored.

Formally, a satisfaction incentive exists if

$$y_B[1-F_B] + \mu_B\phi_B > y_A[1-F_A] + \mu_A\phi_A \qquad (7)$$

and a deprivation incentive exists if

$$\mu_B[1-\phi_B] - y_B[1-F_B] < \mu_A[1-\phi_A] - y_A[1-F_A] \qquad (8)$$

Rearranging terms, the satisfaction condition for an incentive to migrate (the S condition, hereafter) can be written as

$$y_B - y_A > \mu_B F_B[\frac{y_B}{\mu_B} - \frac{\phi_B}{F_B}] - \mu_A F_A[\frac{y_A}{\mu_A} - \frac{\phi_A}{F_A}] \qquad (7a)$$

and the deprivation condition (the D condition hereafter) as

$$y_B - y_A > (\mu_B - \mu_A) + \mu_B F_B[\frac{y_B}{\mu_B} - \frac{\phi_B}{F_B}] - \mu_A F_A[\frac{y_A}{\mu_A} - \frac{\phi_A}{F_A}] \qquad (8a)$$

Note that the terms in square brackets are non-negative. To see this, recall that $\frac{y}{\mu}$ is the slope of the Lorenz curve whereas $\frac{\phi}{F}$ is the slope of the line connecting the Lorenz curve to the origin. Since the Lorenz curve is convex, the non-negativity is ensured. Consequently, it can be easily seen from (7a) and (8a) that if the social parameters are identical, that is, if $\mu_A = \mu_B$, $\phi_A = \phi_B$ and $F_A = F_B$, then the prediction of the deprivation theory will be identical to the prediction of the utility theory; in both cases $y_B > y_A$ is a sufficient condition for an incentive to migrate.

However, if the social parameters differ across societies then a deprivation theory based prediction will be dependent on six parameters; of course not all of them are independent. To render the analysis tractable we shall thus initially restrict our attention to specific cases, where some of the parameters are given. As an aside we point out that if $\mu_A = \mu_B$, that is if the two societies have the same mean income then the S and the D conditions are identical. However, if $\mu_B > \mu_A$, then fulfillment of the S condition is a necessary condition for the D condition to hold whereas if $\mu_B < \mu_A$ then the D condition is a necessary condition for the S condition to hold.

a. Migration of the Richest Person

For the richest person in society A, $\emptyset_A = F_A = 1$. Then the S condition (Eq. 7) is:

$$y_B[1 - F_B] + \mu_B\emptyset_B > \mu_A \tag{9}$$

while the D condition (Eq. 8) is

$$\mu_B[1 - \emptyset_B] - y_B[1 - F_B] < 0 \tag{10}$$

By using Figure 1, it is easy to see that the D condition cannot be satisfied. On the other hand, the S condition is fulfilled if:

$$y_B > \frac{\mu_A - \mu_B \phi_B}{1 - F_B} \tag{11}$$

However, if $\mu_A = \mu_B$, even the S condition cannot be fulfilled. To see this, replace y^* by y_B in Figure 1. BE is $\mu - \mu\phi[F(y_B)]$ and AE is $1-F(y_B)$. Since the absolute Lorenz curve is convex, its slope at A--which is y_B--is smaller than BE/AE. Therefore (11) is invalidated. Hence in this case the richest person in the society has no incentive to migrate. Intuitively, since relative deprivation is bounded from below by zero, the richest individual whose deprivation in A is zero cannot possibly lower it through migration. Note though that if the society at destination is richer than the society at origin, that is, if $\mu_B > \mu_A$ and the individual is expected to be the richest individual in B then, since (7) collapses to $\mu_B > \mu_A$, he can be said to have a strong incentive to migrate. (We say "can" since deprivation decreases only in the weak sense, i.e., it remains unchanged.)

Thus we conclude that in general the richest individual will not have a strong incentive to migrate but may have a weak incentive to migrate.

b. Migration of the Poorest Person

For the poorest individual in A, $F_A = \phi_A = 0$. Hence the S condition is

$$y_B - y_A > \mu_B F_B [\frac{y_B}{\mu_B} - \frac{\phi_B}{F_B}] \qquad (12)$$

and the D condition is

$$y_B - y_A > (\mu_B - \mu_A) + \mu_B F_B [\frac{y_B}{\mu_B} - \frac{\phi_B}{F_B}] \qquad (13)$$

The right-hand side of (12) is non-negative, hence the satisfaction condition is met if $y_B - y_A$ is sufficiently large. From the D condition we can conclude the following: If $\mu_B > \mu_A$ then the poorest individual has an incentive to migrate if y_B is greater than y_A by a large magnitude. Moreover, the richer (in terms of μ_B) society B is, the greater the income increase would have to be to cause migration. On the other hand, if $\mu_B < \mu_A$ then the poorest individual in A may still have a weak incentive to migrate even if his income declines! A poor person may very well endure less deprivation if he were to leave a rich society and join a society where only few persons possess goods which he does not possess. That we do not typically observe migratory moves of this kind must then have to do with the nonfulfillment of the S condition. And indeed, since the S condition cannot be fulfilled in this case, the overall condition for a strong migration incentive does not hold.

Consider now a situation wherein the income of the poorest individual in B is larger than it is in A, i.e., $y_B > y_A$. Assume that conditions (12) and (13) hold. We now wish to check whether under a specific shock to the parameters, conditions (12) and (13) hold a fortiori. We increase the individual's rank in B, i.e., we assume that F_B is larger. However, we keep μ_B and ϕ_B intact. Intuition might have led us to anticipate that the increase in rank will make (12) and (13) hold a fortiori: A higher rank is associated with a more appealing prospect. Apparently this is not the case. By inspecting (12) and (13) we note that in each case, the right-hand side where F_B enters multiplicatively is larger. This is portrayed with the help of Figure 2. The absolute Lorenz curve in society B is OAC and the individual considered is at A. Since $\mu_B\phi_B$ is kept constant, then increasing F_B means that the new absolute Lorenz curve must pass in the region $\overline{AE}$. Since y_B is the same, its slope when it intersects with $\overline{AE}$ is equal to the slope at A. Since μ_B is kept constant, the new curve must pass through C.

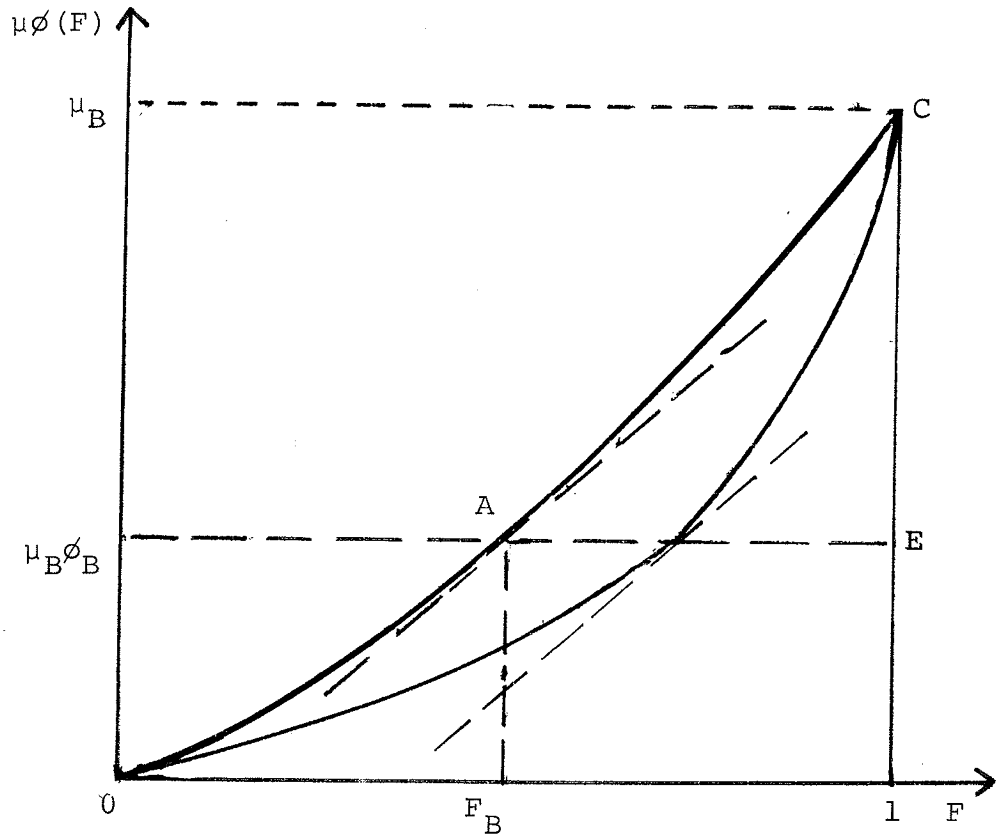

FIGURE 2

Hence increasing F_B, keeping $\mu_B \phi_B$ constant, tends to make society B less egalitarian, causing the individual to feel more deprived (because the rich are richer) and less satisfied (because the poor are poorer).

Thus, we conclude that the poorest individual may have a strong incentive to migrate and also a weak incentive to migrate.

c. Migration of Other Individuals

As we have already pointed out, without restricting the social parameters it is hard to predict the implication of the relative deprivation approach for the incentive to migrate. However, the D and S functions are continuous. Therefore, if the S and D conditions are fulfilled for given incomes, they will be fulfilled in their neighborhood of these incomes. Since we have found that the incentive to migrate for the poorest individual in the society is greater than for the richest, we may conclude that the relative deprivation approach predicts that for a given income differential, the poor have a higher incentive to migrate.

If we restrict $F = F_A = F_B$, that is, assume that the rank of the individual does not change, and assume also that $\phi_B = \phi_A = \phi$, then from (7a) the S condition becomes

$$y_B - y_A > \frac{(\mu_A - \mu_B)}{1 - F}\phi \qquad (14)$$

while from (8a) the D condition is

$$y_B - y_A > \frac{[\mu_B - \mu_A][1 - \phi]}{1-F} \tag{15}$$

and as can be seen from equation (14), the richer society B is, the larger the incentive to migrate for a given difference in incomes. On the other hand, from equation (15), we note that the richer society B is, the larger the income difference $y_B - y_A$ would have to be, in order to have a D incentive to migrate.

An interesting case arises when the individual will be the richest in B. In this case $\phi_B = F_B = 1$. The S condition is

$$\mu_B > y_A[1-F_A] + \mu_A\phi_A \tag{16}$$

whereas the D condition is

$$0 < \mu_A[1-\phi_A] - y_A[1-F_A] \tag{17}$$

The D condition is always fulfilled. Moreover, even the S condition may be fulfilled. This may hold even if $y_B < y_A$. Thus we may conclude that there is always a weak incentive for the second in line to move into a society in which he may be the top man and sometimes--and despite a decline in income--even a strong incentive exists. (See also Frank (1984, 1985)).

III. Deprivation and Migration: A Generalization

Hitherto we have employed a specific formulation of the theory of relative deprivation. Our main motivation in choosing the formulation has been to simplify the presentation. In this Section we adopt a general formulation of the theory. In the preceding Sections we have assumed that the intensity of deprivation of an individual is an increasing linear function of the number of individuals in the reference group who possess commodities the individual does not have. Yet it is possible to argue that the intensity of deprivation is also determined by the utility function as this function weighs the importance of the commodities and that rather than being linear in the number of individuals with higher income, deprivation is a monotonic increasing function of this number. We now incorporate these considerations, intimating as we do so that the implications of our approach for the incentive to migrate do not change in any qualitative way. However, the satisfaction and the deprivation incentives do change quantitatively, i.e., they may become weaker or stronger, depending upon the utility function.

Assume that an individual who does not have the commodities represented by the income range $[y, y + \Delta y]$ feels deprived of $u'(y)$, the marginal utility, and that the intensity of this feeling is, as before, an increasing function of the proportion of the individuals who are not deprived of this income range, that is $1 - F(y)$.

The deprivation of an individual whose income is y will be

$$D_u(y) = \int_y^\infty u'(z)[1 - F(z)]dz \qquad (18)$$

while the satisfaction will be given by

$$S_u(y) = \int_0^y u'(z)[1 - F(z)]dz \qquad (19)$$

For simplicity it is assumed that $u(0) = 0$. Then, the sum of $D_u(y)$ and $S_u(y)$ is equal to μ_u, the expected value of the utility function,[8] and the derivatives of $S(y)$ with respect to income have the same signs as before. The only property that requires modification concerns the relationship between $S_u(y)$ and $D_u(y)$ and the Lorenz curve. It can be shown that

$$S_u(y) = \mu_u[\frac{\partial \phi_u(F)}{\partial F} [1 - F(y)] + \phi_u(F)] \qquad (20)$$

and

$$D_u(y) = \mu_u[1 - \phi_u(F) - \frac{\partial \phi_u(F)}{\partial F} [1 - F(Y)]] \qquad (21)$$

where $\phi_u(F)$ is the cumulative percentage of μ_u that is derived from incomes lower than y, while $\frac{\partial\phi}{\partial F}$ is the slope of the curve.[9] Using the property $\frac{\partial\phi_u}{\partial F} = \frac{u(y)}{\mu_u}$ we can write the D and the S conditions as in (7a) and (7b) except that each y is translated into u(y), and ϕ and μ now carry the subscript u. Having defined the equivalent equations to (7a) and (7b), we can easily redo the preceding analysis with respect to migration. The qualitative conclusions do not change. For example, the richest person in the society may have only a weak incentive to migrate while the poor individual may have a weak incentive as well as a strong incentive. But of course, both incentives now depend on the properties of the u function as it affects the magnitudes of the parameters.

Assume, alternatively, that h[1-F(y)] is not linear. For example, let $h[1-F(y)] = [1-F(y)]^v$ where $v>1$ is a given constant. Then the satisfaction function is given by

$$S(v,y) = \int_0^y [1-F(z)]^v dz \qquad (22)$$

In this case rather than portraying S(y) and D(y) using the absolute Lorenz curve (recall Sections I and II) we would need to utilize a weighted integration of the area below the Lorenz curve (as in Yitzhaki (1983)). Taking the analysis one step further in the generalization ladder we may express the satisfaction function as

$$S_u(y) = \int_0^y u'(z)h[1-F(z)]d(z) \qquad (23)$$

where $h'>0$. Clearly if $h(\cdot)$ converges to a constant, the satisfaction function collapses into the conventional utility function.

IV. Concluding Comments

Students of migration have often failed to take note of the fact that the migration process is blurred by quite a lot of noise--as if it were that the main "regular" phenomenon is accompanied by some "irregular" satellite phenomena. The latter have usually been accounted for by ad hoc explanations and described as anomalies: Migration in the "wrong" direction, in our terminology from A to B while $y_B < y_A$, cannot possibly be explained by those same variables accounting for migration in the "right" direction, that is, from A to B while $y_B > y_A$. Our approach has the valuable characteristic that not only does it add a layer of explanation to the main phenomenon but also that it explains the accompanying phenomena and does so in a novel way.

For example, migration by retired persons, especially to communities characterized by a high ratio of retirees, might be construed as a strategic move aimed at preempting the likelihood of an increase in relative deprivation due to an anticipated, continued growth in the income of the non-retirees (but not of the retirees) in the retirees' origin reference group. The relative deprivation approach may thus give rise to life cycle based migratory predictions.

Return migration by successful migrants which is, by definition, a form of migration, is very often associated with a departure from a rich society (economy) to a less rich one. It appears as though maximal overall gains associated with migration accrue if at appropriate points in time, _two_ substitutions of reference groups take place: One, associated with the first move; the other, accruing as a successful migrant decides to return when _rank-wise_ his progress in the receiving community appears to grind to a halt.

Our analysis also has a bearing upon phenomena other than migration narrowly defined. For example, the third most senior executive in one corporation departs to become the chief executive officer in another corporation in a move which cannot possibly be sustained by considerations of income or income growth prospects.

We have seen that inequality _per se_ has a bearing on migration propensities. The fad in empirical migration research of characterizing--hence ranking--sending and receiving societies (sectors) by their mean income alone may thus omit an important explanatory variable. Our theory gives rise to the belief that migration depends on the inequality in the distribution of income by size in the sending and receiving societies, that it is positively correlated with inequality in the society of origin, and that it is negatively correlated with inequality in the society of destination.

On the basis of our discussion in Section II we may also note that the incentive to migrate is not a function of income levels but rather, and exclusively so, of income differentials. In order to verify this we may return to equation (3). Note that if we add a constant amount to the income of each and every individual, then satisfaction changes exactly by this constant whereas deprivation does not change at all. Hence if we add the same constant amount to all incomes in A as well as in B, conditions (7) to (17) will remain exactly the same; absolute levels of income play no role at all. This cannot be said to hold under the utility-welfare function approach where, due to declining marginal utility, addition of a constant amount reduces the incentive to migrate throughout. Notice though that the conclusion pertaining to the robustness of conditions (7) to (17) may not hold once a u function is introduced (as in Section III).

FOOTNOTES

[1]Runciman uses the example of promotions and writes: "The more people a man sees promoted when he is not promoted himself, the more people he may compare himself with in a situation where the comparison will make him feel relatively deprived," (1966, p. 19).

[2]For a detailed and explicit derivation of this equation from Runciman's axioms see Yitzhaki (1982).

[3]The reader might question our definition of D(y), pointing out that intuitively 1-F(y) might do just as well. Unfortunately, such is not the case. If, for example, the income of an individual who is richer than our reference individual increases, F(y) remains unchanged and so does 1-F(y). Yet a proper measure of relative deprivation should be sensitive to there now being more income units the reference individual is deprived of. D(y) as defined in (1) exhibits such sensitivity.

[4]Proof: $S(y) + D(y) = \int_0^{\infty} [1-F(z)]dz$

and by using integration by parts where $u = z$ and $v = 1-F(z)$ we obtain

$$\int_0^{\infty} [1-F(z)]dz = [1-F(z)]\, z\Big|_0^{\infty} + \int_0^{\infty} zf(z)dz = \mu.$$

[5]Proof:

Using integration by parts where

$v(z) = 1-F(z)$, $v'(z) = -f(z)$; $u(z) = z$ and $u'(z) = 1$ and the property $\lim_{y\to\infty} [1-F(y)] = 0$ we obtain

$$D(y) = \int_0^\infty [1-F(z)]dz = -[1-F(y)]y + \int_0^\infty zf(z)dz.$$

Using the conditional density function

$$f^*(z|z>y) = (1/[1-F(y)])f(z)$$

we insert $f(z)$ into the last integral to obtain the expression as in d.

[6]Proof:

$$S(y) = \int_0^y [1-F(z)]dz$$

and by using integration by parts

$$S(y) = y[1-F(y)] - \int_0^y zf(z)dz = \mu[\frac{y}{\mu}[1-F(y) - \phi(F(y))]]$$

where ϕ is the Lorenz curve. Noting that $\frac{y}{\mu} = \frac{\partial\phi}{\partial F}$ completes the proof.

[7]Shorrocks (1983) refers to the absolute Lorenz curve as the "generalized Lorenz curve."

[8]Proof:

$$S_u(y) + D_u(y) = \int_0^\infty u'(z)[1-F(z)]dz$$

using integration by parts, we get

$$u(y)[1-F(y)]\Big|_0^\infty + \int_0^\infty u(z)f(z)dz = \mu_u + u(0)$$

assuming u(0) = 0 completes the proof.

[9]Proof:

$$S_u(y) = \int_0^y u'(z)[1-F(z)]dz =$$

which by using integration by parts decomposes to

$$= u(y)[1-F(y)]\Big|_0^y + \int_0^y u(z)f(z)dz$$

$$= \mu_u\Big[\frac{u(y)}{\mu_u}[1-F(y)] + \frac{1}{\mu_u}\int_0^y u(z)f(z)dz\Big]$$

$$= \mu_u\Big[\frac{\partial\phi_u(F)}{\partial F}[1-F(y)] + \phi_u(F)\Big]$$

where $\phi_u(F) = \frac{1}{\mu_u} \int_0^{\infty} u(z)f(z)dz$ is the percentage of u derived from income lower than y.

The derivative of $\phi_u(F)$ with respect to F (the cumulative distribution of income) is derived indirectly by

$$\frac{\partial \phi_u(F)}{\partial F} = \frac{\partial \phi_u / \partial y}{\partial F / \partial y} = \frac{u(y)f(y)}{\mu_u \; f(y)} = \frac{u(y)}{\mu_u} .$$

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