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Labor Migration, Consumption Scale Economies
and Income Variance

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Abstract

Katz and Stark (1986) have proposed two reasons for rational workers to migrate to urban areas even when the urban expected income is lower than rural income. We propose two more, viz., scale economies in consumption and differential income variance in favor of the urban area. In each case, global risk aversion is retained.

Running head: Labor Migration and Consumption Economies

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I. Introduction

Rural-urban migration has for the last two decades now been viewed largely through the lenses of the Harris-Todaro model (Todaro, 1969; Harris and Todaro, 1970). The well-known equilibrium condition states that the flow into the urban area will cease once rural income attains a level equal to urban income times the probability of employment in the urban area. The evidence, has, however, failed to point conclusively in the direction of the intuitive simplicity of Harris-Todaro (Banerjee and Kanbur (1981) in India; Salvatore (1981) in Italy and Garrison (1982) in Mexico). Indeed, expected urban income has been observed to be in many cases lower than rural income. This is the empirical paradox that Katz and Stark (1986) confronted and attempted to put to rest.

Their (Katz and Stark's) strategy was to demonstrate that the rationality assumption does not preclude the acceptance of actuarially unfair gambles which is precluded in Harris-Todaro. Their first explanation involved assuming increasing returns to investment in the presence of capital market imperfections in rural LDCs - a tack first taken by Applebaum and Katz (1981). This mechanism is mediated by the widespread existence of

remittance of income. Their second explanation involved assuming increasing returns in the status function from the argument wealth. The result in both cases is acceptance of an actuarially unfair gamble even under global risk aversion.

In this paper, we enrich the set of mechanisms that may in fact explain the cited empirical paradox without deflating the role of rationality and global risk aversion. Our first explanation dovetails Katz and Stark (1986) and Appelbaum and Katz (1981) very closely. It involves assuming the existence of scale economies in household consumption. Scale economies in household consumption is an area of growing interest (Lazear and Michael, 1980; Pollak and Wales, 1981). Of late, Nelson (1988) has provided an innovative way to measure scale economies in the consumption of five goods from the US Consumer Expenditure Survey. Although consumption scale economies could arise from household size, which Nelson emphasizes in view of data available, "most economies of scale from household production or bulk purchasing should be directly related to the physical quantity (e.g. number of ounces, square feet, etc.) of the good produced or purchased, rather than to household size" (Nelson, 1988, footnote 3). Pollak and Wales (1981) are very emphatic on this and we agree with them here. Our contention here is that consumption scale economies are even more pronounced in rural LDCs where income, which affects the quantity of consumption goods produced or purchased, is very depressed. This is, for example, very pronounced in the nutrition-productivity linkage

where the relationship is observed to be S-shaped (Spurr, 1984; Svodverg, 1988; Dasgupta and Ray, 1986).

The other explanation dovetails the Katz and Stark second explanation by introducing an additional argument in the worker's utility function but without their emphasis on an unfair gamble. We assume that the worker is confronted not only by uncertainty involving employment but when employed, there is the uncertainty of the level of income. This is most pronounced in the rural area where the probability of employment may be 1 (it is assumed so in most models, for convenience) but the actual income is subject to the vagaries of nature. To illustrate, a farmer's son in the family farm is assured of work by the institutional structure but his realized income depends on rainfall and other climatic conditions. One can interpret the climate to include political as well as security considerations which may be of great interest in many rural LDCs.

Section 2 describes the model, with our hypothesis about scale economies in household consumption made precise. The conditions under which a risk-averse family member accepts migration as an unfair gamble are derived. Section 3 discusses the notion of induced risk preference. Section 4 introduces differential income variance and shows that migration could be occurring even when the "employed" income in the urban area is lower than the rural income. Section 5 gives a brief conclusion.

II. Model I: Scale Economies in Consumption

The decision to migrate is assumed to be a family decision rather than an individual decision (see Mincer, 1978; Stark, 1983; Lucas and Stark, 1985). The family is assumed to have a Von Neumann-Morgenstern utility function U over consumption C that displays risk aversion, i.e., $U' > 0$, $U'' < 0$. The variable C is generated via a production process F defined over family income Y . We let $Y = y_0 + y$, where y_0 is the pooled income of all other members of the family including returns from, say, existing family assets, and y is the income of the potential migrant member. If the member in question stays at home in the rural area, his income is y^r . However, if he moves to the urban sector and gets employed, his net income is y^u ; if he migrates and fails to get employed, he incurs a cost which we denote by h . The probability of employment in the urban area, q , is exogenous.

A variant of Becker's (1965) household production function is used to describe consumption. The role of the production process generating household consumption is central in this paper. In a rural setting, on condition that the household has readily available cash, the possible origins of scale economies in consumption are many. We observe, for instance, source economies whereby the household is able to buy from the town during a specially designated market day rather than from the village or landlord's store. This cuts cost considerably, and as

a result, more consumption is realized from any given amount of money. There are also financing economies, in which the household is able to procure goods and services without having to borrow at an exorbitant interest rate. This, of course, is also in line with Katz and Stark's assumption of an imperfect financial market.

Increasing consumption returns from an increase in income may also arise given the possible overlap between economic and biological factors. In a low-income country, for instance, the desire for higher income may lead to a desire for better food which could then result in better health. Thus, it has been observed that the work effort-nutrition relationship is S-shaped (see, e.g., Spurr, 1984; Svedberg, 1988; Dasgupta and Ray, 1986). In formal terms, what is suggested by these findings is a particular shape for the household production function $C = F(Y)$. We posit that $F' > 0$ and $F'' > 0$ for some interval of Y . For the household scale economies in household consumption to be realized, we assume that the migrant worker voluntarily remits to the household he belongs to.

We now incorporate the above assumptions about household preferences and production technology in the migration decision. The family will be indifferent between a member migrating or staying if

$$U[F(y_0 + y^r)] = q U[F(y_0 + y^a)] + (1-q)U[F(y_0 - h)]. \quad (1)$$

Thus, the family is modeled as facing a gamble with y^u as the payoff for winning with probability q . Meanwhile, $-h$ is the payoff for losing. For simplicity, we let $y^u = ay^r$ or that the urban income is a multiple of the rural income with $a > 0$. Totally differentiating (1) and solving for (dh/da) we have

$$0 = qU'[F(y_0 + ay^r)]F'(y_0 + ay^r)y^r da - (1-q)U'[F(y_0 - h)]F'(y_0 - h)dh. \quad (2)$$

Locally at $a = h = 0$, the above becomes simply

$$\left. \frac{dh}{da} \right|_{a=h=0} = \left[\frac{q}{1-q} \right] (y^r). \quad (3)$$

Having shown this, we solve for the second derivative (d^2h/da^2)

(2). Letting

$$\begin{aligned} K(a) &= U'[F(y_0 + ay^r)]F'(y_0 + ay^r)y^r \\ J(h) &= U'[F(y_0 - h)]F'(y_0 - h), \end{aligned} \quad (4)$$

we have from (2):
$$\frac{d^2h}{da^2} = \left[\frac{J(h)K_a - K(a)J_h}{[J(h)]^2} \right] \left[\frac{q}{1-q} \right] \quad (5)$$

where $K_a = \partial K / \partial a$ and $J_h = \partial J / \partial h$.

Now

$$\begin{aligned} K_a &= \{U''[F(y_0 + ay^r)][F']^2 + U'[F(y_0 + ay^r)]F''\}(y^r)^2 \\ J_h &= \{U''[F(y_0 - h)][F'(y_0 - h)]^2 + U'[F(y_0 - h)]F''\}(-1). \end{aligned} \quad (6b)$$

The following result is well-known and stated without proof: A necessary and sufficient condition for a player to refuse a fair bet is, that the isoutility curve $h = G(a, Y_0)$ is concave. The isoutility curve is derived from (2).

Proposition 1: Suppose the household is strictly risk-averse

($U' > 0, U'' < 0$) with respect to C . (a) Let the household consumption function be concave ($F' > 0, F'' \leq 0$). Then the isoutility curve, $h = G(a, Y_0)$, is strictly concave. (b) Let the household consumption function exhibit scale economies ($F' > 0, F'' > 0$). Then the household may favor migration even when $Y_r \geq qY_u + (1-q)(-h)$.

Proof: (a) The isoutility curve $h = G(a, Y_0)$ is generated from (1). Its slope locally at $a = h = 0$ is given by (3). It is strictly concave if $(d^2h/da^2) < 0$. With $J(h) > 0, J(h)K_a < 0$ if $K_a < 0$. Inspecting (6a), this is clearly the case. Now $K(a) > 0$ and $K(a)J_h > 0$ if $J_h > 0$. Equation (6b) shows that $J_h > 0$ if $U'' < 0$ and $F'' \leq 0$. Since $dh/da > 0$ from (3), $h = G(a, Y_0)$ is strictly concave.

(b) The proof of (a) shows that if $F'' > 0$, the sign of (5) could be positive and an unfair gamble with $Y_r \geq qY_u + (1-q)(-h)$ may indeed be acceptable. Q.E.D.

It follows from our model that scale economies in household consumption function can induce migration without the Harris-Todaro crutch of higher average urban income relative to rural

income. As in Katz and Stark, the average urban income may well be lower with migration going on. The implication of our analysis is that although the alleviation of rural financial market imperfections would clearly help, it is really in the arena of absolute rural income levels that the battle must be won. Our view is that the most compelling scale economies are related to low absolute levels of income, e.g., the S-shaped linkage between nutrition and productivity. This introduces a new twist into the debate. Whereas the migration debate was and is dominated by relative income levels, the result of this section emphasizes the role of the absolute income level via the scale economies in consumption.

III. Induced Risk Preference

It is interesting to further inquire as to when scale economies in consumption (or in other intermediate activities) can induce acceptance of an unfair gamble. Let $V(Y) = U(F(Y))$. The following, which states when this never happens, is obvious from (5):

Proposition 2: The household will never decide in favor of migration when the average urban income is lower than the average rural income if $V(Y)$ is strictly concave, i.e., exhibits risk aversion.

Proof: If $V(Y)$ is concave,

$$V''(Y) = U''(F')^2 + U'F'' < 0. \quad (7)$$

But the bracketed expression in K_a and J_h in (6) are identical to (7) and, thus, negative. Thus, $(d^2h/da^2) \leq 0$ and $G(a, Y_0)$ is concave. Q.E.D.

This observation is of some interest. Note that certain proposed alternative to Harris-Todaro involve direct risk preference, perhaps of the Friedman-Savage variety (Sabota, 1968), an explanation not favored by Katz and Stark. What is happening here, as in Katz and Stark, is that the scale economies reintroduces risk preference of a different sort. Thus, in our case, acceptance of an unfair gamble is possible only when $V(Y)$ exhibits risk preference in income although the household is risk-averse in consumption. In Katz and Stark, the household is risk-averse in the final variable but should exhibit risk preference in the intermediate variable as well. Induced risk preference, although frequently observationally indistinguishable from direct risk preference, really improves the texture of the debate.

It seems obvious from (5) that not every consumption scale economies get translated into the non-concavity of $G(a, Y_0)$. Is it possible to define combinations of U and F such that the concavity of $U(Y)$ is always guaranteed, i.e., as refusal of unfair gambles? Fabella (1988) has shown that if F is (i, g) -concave and U is (g, i) -concave, where $g(\cdot)$ is concave, then $V(Y) = U(F(Y))$ is always concave. Now an (i, g) -concave function is quasi-concave and can exhibit scale economies. For example,

$C = F(Y) = Ae^Y$ is (i, g) -concave. Every (g, i) -concave function is concave. An example, is $U(C) = \log C$, so that $V(Y) = U(F(Y)) = \log A + Y$ which is concave in Y . In this case, consumption scale economies will never translate into a risk preference for income so that migration will not occur with average urban income lower than average rural income. Suppose, however, that $C = F(Y) = Y^2$ which is $(i, (.)^2)$ -concave while $U(F) = (F)^{2/3}$ which is not $((.)^2, i)$ -concave. Then $V(Y) = Y^{4/3}$ and (7) is violated. This clearly requires further analysis since one may encounter problems with nonconcavity outside the quasi-concave orbit.

IV. Model II: Differential Variances

Another way to come to grips with the empirical paradox is to resort to another attribute of income that tends to vary as one moves from rural to urban setting. The literature has tended to dwell only on probability of employment and has strangely remained oblivious of possible variations in income levels once employed. In the orbit of the family farm, the farmer's son will always be employed. But his income as a farm hand could experience large variations over a period due largely but not exclusively to climatic changes. There could be rapid price changes and political developments that affect production. Insurance against these risks are either nonexistent or, when available, or home-made, tend to be very costly. In contrast, a formal sector job tends to deliver a relatively more stable income level. A farmer's son or a daughter in the urban formal

sector can, and in fact do, act as an insurance against an adverse turn of events. We assume that the migrant worker has a continuous, twice differentiable utility function defined over average income and income variance:

$$U = U(Y_i, V_i), \quad U_y > 0, U_{yy} < 0, U_v < 0, \quad (8)$$

$$i = u, r,$$

where y_i is average income in $i = u$ (urban) or r (rural), V_i is income variance, $U_y = \partial U / \partial y_i$, $U_{yy} = \partial^2 U / \partial y_i^2$, $U_v = \partial U / \partial v_i$. Thus, utility is strictly decreasing in income variance. If the decision unit is the household, then y_i is average family income in i and V_i is the variance in i of family income. Both of these are then affected by changes in average income and income variance of a migrating member. With employment probability, $0 < q < 1$, being exogenous, indifference between migrating and staying is attained at

$$U(Y_r, V_r) = qU(Y_u, V_u) + (1-q)U(-h, 0), \quad (9)$$

where $(-h)$ is the cost of sustenance while unemployed. Note that we have dropped Y_0 (used in the previous model) for convenience. Is migrating a fair gamble when $Y_r > Y_u$? Put in another way, is migration sensible even when the average "employed" urban income is lower than the rural income? Note that this is stronger than asking whether migration can occur when the average urban income $[qY_u + (1-q)(-h)]$ is lower than the urban income Y_r .

Proposition 3: Suppose $V_r > V_u$. Then there exists a $\beta > 0$ and a q' , $0 < q' < 1$, such that

$$U(Y_u + \beta, V_r) = q'U(Y_u, V_u) + (1 - q')U(-h, 0). \quad (10)$$

Proof: It is clear that as long as

$$U(Y_u, V_u) > U(Y_r, V_r) > U(-h, 0),$$

one can always find a q , $0 < q < 1$, so that (9) holds. If $V_r > V_u$, then the first inequality still holds even if we let $Y_r = Y_u$, i.e., $U(Y_u, V_u) > U(Y_u, V_r)$ since $U(\cdot)$ is strictly decreasing in variance. By the mean value theorem, since $U(\cdot)$ is continuous and differentiable,

$$U(Y_u + \beta, V_r) - U(Y_u, V_r) = U_y(\epsilon, V_r)\beta, \quad (11)$$

where $(Y_u + \beta) > \epsilon > Y_u$. This difference approaches zero as $\beta \rightarrow 0$. Thus, for small enough $\beta > 0$, $U(Y_u, V_u) > U(Y_u + \beta, V_r) > U(-h, 0)$. Thus one can always find q' , $0 < q' < 1$, so that (10) holds. Q.E.D.

Thus, given a variance differential in favor of the urban area, there is an employment probability and an "employed" income differential in favor of the rural area so that migration pays. This is a stronger result than the previous model's and those of Katz and Stark's where average urban income is compared with rural income. Another way of putting this is also instructive: Suppose $V_r = V_u + \delta$, $\delta > 0$. Then, given q , $0 < q < 1$, there exists a $\delta > 0$ so that

$$U(Y_u + \beta, V_u + \delta) = qU(Y_u, V_u) + (1-q)U(-h, 0).$$

The proof is analogous and is not given. This means that there is a high enough differential in income variance in favor of the urban area so that given the employment probability and an average income differential in favor of the rural area, the worker will still migrate. This happens despite the fact that $Y_r > Y_u$. Thus, an unintended effect of agricultural insurance provision may be less worker inflow into the urban areas. This also encompasses the phenomenon of migration due to political instability in the rural areas.

V. Concluding Remarks

We have presented two models of labor migration: the first adopts the induced risk preference mechanism in common with Katz and Stark. It relies on the assumption of scale economies in household consumption to generate the empirically observed phenomenon whereby rural-urban migration proceeds even if expected urban wage falls below the rural wage.

From a policy standpoint, correcting rural capital market imperfections, as Katz and Stark suggest, may not be enough to stem the tide of rural-urban migration. This effort, it would seem from our results, must be accompanied by policies to raise rural incomes to a level where scale economies in consumption are no longer as pronounced. We have thus highlighted the role of absolute income levels in an area largely dominated by relative income comparisons.

The second model follows Katz and Stark's second approach in that it introduces a second argument in the utility function. While they resorted to "status" which is increasing at an increasing rate in wealth, we focused attention on the more natural and popular device of income variance. Assuming rural income variance being greater than urban income variance, we showed that not only that average urban income could be lower than average rural income while migration into the urban areas continues, but even that the very income "when employed" could be lower than the rural income. The policy implication is that an unintended side-effect of agricultural insurance protection may be lower inflow of workers into the cities.

REFERENCES

- Appelbaum, E. and E. Katz. "Market Constraints as a Rationale for the Friedman-Savage Utility Function," Journal of Political Economy 89 (1981): 819-825.
- Becker, Gary S. "A Theory of the Allocation of Time," Economic Journal 75 (1965): 493-517.
- Dasgupta, Partha and Ray, Debraj. "Inequality as a Determinant of Malnutrition and Unemployment: Theory," Economic Journal 96 (December 1986): 1011-1134.
- Fabella, Raul V. "Quasi-concave Composition Functions with Nonconcave-Argument Functions," Working Paper, School of Economics, University of the Philippines, 1988; under revision for International Economic Review.
- Garrison, Helen. "Internal Migration in Mexico: A Test of the Todaro Model," Food Research Institute Studies 18 (1982): 197-214.
- Harris, John R., and Todaro, Michael P. "Migration, Unemployment and Development: A Two-Sector Analysis," American Economic Review 60 (March 1970): 126-142.
- Lazear, E. P. and Michael, R. T. "Family Size and the Distribution of Real Per Capita Income," American Economic Review 70 (1980): 91-107.
- Lucas, Robert E.B. and Stark, Oded. "Motivations to Remit," Journal of Political Economy 93 (October, 1985): 901-918.
- Mincer, Jacob. "Family Migration Decisions," Journal of Political Economy 86 (1978): 749-773.
- Nelson, Julie A. "Household Economies of Scale in Consumption: Theory and Evidence," Economica 56 (November, 1988): 1301-1314.
- Pollak, R. A. and Wales T. J. "Demographic Variables in Demand Analysis," Econometrica 49 (1981): 1533-1551.
- Sahota, Gian S. "An Econometric Analysis of Internal Migration in Brazil," Journal of Political Economy 76 (March/April 1968): 218-245.
- Salvatore, Dominick. "A Theoretical and Empirical Evaluation and Extension of the Todaro Migration Model," Regional Science and Urban Economics 11 (November 1981): 499-508.

Katz, Eliakim and Stark, Oded. "Labor Migration and Risk Aversion in Less Developed Countries." Journal of Labor Economics 4 (1986): 134-149.

Spurr, G. B. "Nutritional Status and Work Capacity," Yearbook of Physical Anthropology 26: 1-35.

Svedberg, Peter. "A Model of Nutrition, Health and Economic Productivity," Seminar Paper No. 106, Institute for International Economic Studies, Stockholm (September 1988).

Todaro, Michael P. "Urban Job Expansion, Induced Migration and Rising Unemployment in Less Developed Countries," American Economic Review 59 (March 1969): 138-148.