AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

No endorsement of AgEcon Search or its fundraising activities by the author(s) of the following work or their employer(s) is intended or implied.

HIID

569

Development Discussion Papers

Reprint Series

LIBRARY
FEB 5 1998
WITHDRAWN
GIANNINI FOUNDATION OF
AGRICULTURAL ECONOMICS

Harvard Institute
for International Development

HARVARD UNIVERSITY

VE RI TAS

HIID

569

Development Discussion Papers

Reprint Series

THEORIES OF MIGRATION

John Luke Gallup

Development Discussion Paper No. 569
January 1997

LIBRARY
FEB 5 1998
WITHDRAWN
GIANNINI FOUNDATION OF
AGRICULTURAL ECONOMICS

Harvard Institute
for International Development

HARVARD UNIVERSITY

VE RI TAS

THEORIES OF MIGRATION

John Luke Gallup

Development Discussion Paper No. 569
January 1997

Harvard Institute for International Development
Harvard University
One Eliot Street
Cambridge, Massachusetts 02138
617-495-2161
Fax: 617-495-0527
http://www.hiid.harvard.edu

Theories of Migration

John Luke Gallup

This paper surveys theoretical models of migration decision-making. It considers more or less chronologically: the gravity model, the human capital model, expected income, the two-sector model, family decision-making, information and networks, search models, and return migration. It is followed by a general expected utility decision-making framework within which the earlier models are situated.

John Luke Gallup is an Institute Associate at HIID and a Lecturer in the Department of Economics at Harvard University. His recent research includes work on the determinants of fertility in Vietnam and the relationship between growth and poverty alleviation.

The study of migration has several motivations. It is an important event in any migrant's life, being a change of residence, job, and often of culture and country. It has important economic and cultural effects on the receiving and sending communities. Migration is a means by which the sectoral shifts of development and growth are effected. The classic transition from a rural agricultural economy to an urban industrial economy occurs in part through labor migration from the country to the city. Migration is an important concern for those worried about urbanization and the growth of cities.

On the theoretical side, migration is interesting as an adjustment mechanism in the labor market. As an equilibrating mechanism, it is inherently a dynamic phenomenon. It is specially beset with problems of uncertainty. Given the fixed costs of migration (costs of adjustment), we should not expect it to be a perfect adjustment mechanism. It has lags and builds upon itself.

This paper will survey theoretical models of migration decision-making.[1] It is divided into more or less chronological sections in the development of migration theory: the gravity model, the human capital model, expected income, the two-sector model, family decision-making, information and networks, search models, and return migration. It is followed with a general expected utility decision-making framework within which the earlier models are situated.

I. The Gravity Model

Back when social science was more self-assured, H. C. Carey (1858-59) asserted that migration followed the laws of Newtonian physics: 'Man, the molecule of society, is the subject of Social Science.... The great law of Molecular Gravitation [is] the indispensable condition of the existence of the being known as man.... The greater the number collected in a given space, the greater is the attractive force that is there exerted.... Gravitation is here, as everywhere, in the direct ratio of the mass, and the inverse one of distance.'[2] That is:

$$M_{ij} \propto \frac{P_i P_j}{D_{ij}^{2}}$$

where M_{ij} = migration from region i to region j
P_i, P_j = population in region i and j, respectively
D_{ij} = distance between region i and region j.

This relationship and simple modifications of it were used to explain migration for the next hundred years[3], and continue to be used for the estimation of migration by

---

[1] There are several other surveys of the migration literature, but surprisingly, none of them analyze the development of the theoretical models in any detail. This survey is quite narrow in its purpose and is meant to supplement the more general discussions. See Massey, *et al.* (1993) for a good survey of conceptual approaches to migration, and Mazumdar (1987) for a discussion of empirical findings in less industrialized countries. Other surveys are Lucas (Forthcoming), Greenwood (Forthcoming, 1975), Borjas (1994), Massey, *et al.* (1994), Williamson (1988), Molho (1986), Schultz (1982a), contributions in De Jong and Gardner (1981), especially Da Vanzo, Todaro (1980), Antel (1980), and Yap (1977).

[2] Carey (1858-59) pp. 41-43.

[3] Carrothers (1956) p. 102n.

geographers and regional scientists. Empirically, these correlations are strong, probably due to transport costs, information flows, and economies of agglomeration.[4] The weakness of the gravity model is that it is not a model of individual behavior. It does not describe the decision to migrate, at least not credibly.[5]

II. Human Capital

The first model of individual migration decision-making in the economic mold was Sjaastad (1962). Sjaastad presented the migration decision as a human capital investment problem in which the potential migrant assesses the costs and returns of moving. Migrants move when there is a net positive return, which in practice is mainly determined by labor market earnings differences.

The migrant incurs the money cost of traveling to a new location, as well as the non-money costs of losing accrued job experience, the "psychic" costs of leaving friends, family, and familiar surroundings, and the discomfort of uncertainty. The migrant gains a higher expected earning stream and the "psychic" benefits of the new destination, if any, that are necessary to induce him or her to migrate. The future returns to staying or moving depend on complementary human capital investments such as education and job experience.

Sjaastad was concerned to explain the persistence of earnings differentials which are not eliminated by migration. As long as migration involves costs to the migrant, earnings will not be equalized. Besides the money costs of migrating, Sjaastad emphasized the cost of changing jobs and the loss of utility not due to income differences. The older the migrant, the fewer the years of payoff from the human capital investment in migration, while the cost of migration remains just as high, which helps to explain why migration diminishes with age. But Sjaastad argued that the lost human capital from switching jobs is more important than a foreshortened time horizon in explaining the strong relationship between age and migration.

Sjaastad put the migration decision in a framework of maximizing the net benefits from moving or staying. He separated these factors into the difference in wages and the difference in certain non-wage benefits and costs. Sjaastad also put time into the problem.

III. Expected Income Hypothesis

Todaro (1969, 1980) formalized some of the ideas of Sjaastad, adding a new emphasis on the uncertainty of finding a new job and the migrant's impact on unemployment. Although Todaro assumed that the migrant knows the wage at his or her

---

[4] Schultz (1982) p.560.

[5] Molho (1986), however, discusses several attempts to derive the gravity model from utility maximization. See also Schultz (1982, 1982a).

destination, only a portion of migrants are able to find jobs initially. The migrant will compare the expected income at the destination (the city) with the sure income earned at home (the country). The migrant will move if the discounted value of the expected earnings differential between the country and the city is greater than the costs of moving.

Let V_0 be the present discounted value of the expected gain from migrating over the migrant's time horizon, T. y_u is the fixed real urban income, and y_r is the fixed real rural income, p_t is the probability of being employed in urban sector at time t, β is the migrant's rate of time preference, and C_0 is the cost of moving (incurred at time $t=0$, the present). $0 < \beta < 1$, and the migrant values an income of y_1 earned in time period 1 the same as an income of $y_0 = \beta y_1$ earned in time period 0. The decision to migrate depends on whether

$$V_0 = \sum_{t=0}^{T} (p_t y_u - y_r)\beta^t \quad - \quad C_0$$

is positive or negative.[6] The probability of being employed in the city in each period, p_t, is a function of the probability of being offered a job in each period, π_t:

$$p_0 = \pi_0, \quad \text{and} \quad p_t = p_{t-1} + (1 - p_{t-1})\pi_t \quad \text{for} \quad t > 0$$

Only the unemployed are offered jobs, and once employed, the worker keeps his or her job forever. If the probability of an unemployed worker getting a job is the same every period ($\pi_t = \pi \ \ \forall t$), then the unemployed worker who waits long enough will eventually get a job:

$$p_t = 1 - (1 - \pi)^{t+1} \rightarrow 1 \quad \text{as} \quad t \rightarrow \infty.$$

The main policy implication of this model is that urban job creation will increase the number of urban unemployed (observing this in Nairobi is what gave Todaro the idea for the model).[7] New jobs in the city will initially increase the probability of getting an urban job. A higher probability of getting a job will induce migration until the influx of new workers drives down the probability of getting a job to its previous level (wages are fixed throughout). The result is more workers in the city with the same probability of getting a job as before, hence more employed and more unemployed workers.

Todaro introduced important new elements into the modeling of migration, but his formulation has several shortcomings. Though it introduces the consideration of expected income, the actual wage is assumed known and fixed over time. The migrant considers future earnings, but does not consider that he or she may migrate in the future - it is not really a dynamic decision. Implicitly, the worker considers migrating only once (presumably at the moment the researcher observes the migrant), and once the choice is

---

[6] This formalization has been converted to a discreet time sum from Todaro's continuous time integral because Todaro mixes the continuous time V_0 with the discreet time p_t in an inconsistent way. Todaro got rid of some of the inconsistency, but not all of it, in his 1980 summary article.

[7] Todaro simplifies the model when looking at comparative statics by reducing the time horizon to a single period. He asserts that this "is in fact a more realistic formulation in terms of actual decision making in less developed nations." (Todaro, 1969, p. 143n.)

made, it is irrevocable. Finally, the way in which migrants find jobs in the city is odd. Some migrants wait for a job for an infinite time period after they move to the city.

IV. The Two-Sector Model

There are three things notable about the Harris-Todaro model: people paid much more attention to it than to Todaro (1969), migration is integrated into a two-sector model (where it is the labor market equilibrium condition), and the specification of migration is drastically simplified. Harris-Todaro assumed that the rural wage is fixed, the urban wage is fixed above the market clearing level (as in Todaro (1969)), the probability of getting a modern-sector job is equal to the rate of employment, and there are no costs of migrating.

The migration decision is reduced to a single-period comparison of expected wages, and the probability of getting a job is equal to the fraction of urban workers employed. Rural to urban migration occurs if $w_u(1-U) > w_r$, where w_u is the urban wage, w_r is the rural wage, and U is the urban unemployment rate (there is no rural unemployment). This implies completely random hiring every period. It is as if all employed workers were fired at the end of every year and then new workers were hired in a lottery of the labor force.

There have been many extensions and modifications of the Harris-Todaro model. Three of the better ones were proposed by Fields (1975). He was motivated by the fact that Harris-Todaro predicts a higher equilibrium unemployment rate than he found plausible. If urban modern-sector wages in less developed countries (LDCs) are two times as high as in rural areas, Harris-Todaro predicts unemployment rates of 50%.[8]

Fields proposed first that it is possible to search for an urban job from a rural area, though with less efficacy than being on location in the city. If π is the probability of finding a modern-sector job while searching from the city, $n\pi$ $(0<n<1)$ is the probability of finding a modern-sector job while searching from the countryside. Those who choose a rural-based search will only migrate when they have secured an urban job. Banerjee (1991) finds that 17% of a sample of Indian rural-urban migrants had a job lined up before they migrated. Rural-based search reduces equilibrium unemployment because the rural-based searchers remain employed while searching.

Fields also allowed for the existence of both open unemployment and employment in the urban traditional sector. As with rural-based search, those employed in the urban traditional sector can search for a modern-sector job, but with diminished probability of attaining one compared to the unemployed. If π is the probability of finding a modern-sector job while unemployed, $h\pi$ $(0<h<1)$ is the probability of finding a modern-sector job while employed in the traditional sector.

Fields' third addition was a modern-sector queue by education. The modern sector will hire all the educated workers before it hires any uneducated workers. This

---

[8] In equilibrium, $w_u(1-U) = w_r$ so $w_r/w_u = ½ = 1-U$.

effectively reduces the number of modern sector jobs for the (uneducated) migrant, and so will reduce the migrant's probability of getting a job, and hence will mean less unemployment.

Fields notes the importance of job turnover assumptions for the predicted unemployment rate. In Harris-Todaro, all jobs turn over every period, while in Todaro, there is no job turn-over (once a worker is hired, he or she never quits or is fired). Johnson (1971) showed that the equilibrium unemployment rate and the rate of job turnover vary directly in the two-sector model, so that assuming jobs turn over every period increases the predicted unemployment rate given a rural-urban wage differential.

There are many other modifications of the Harris-Todaro model. For instance, Corden and Findlay (1975) allow for capital mobility as well as labor mobility. However, few of these modifications make any innovation in the underlying model of the migration decision-making - they modify the specification of the rest of the economy to explore its effect on the relationship between migration and urban unemployment.

V. Family Decision-Making

Mincer (1978) points out that migration is often a family, not an individual decision. He considers families which migrate together, where the family gain from migration is the sum of the gains to each member of the family.[9] Only by coincidence will the best migration location be the same for all members of the family. This makes families less mobile than unattached persons. It also results in 'tied' movers and stayers: family members who migrate or stay at home because it is in the family interest to do so, but is not in their interest as individuals. The family member(s) whose gain dominates the tied family member's gain (typically the husband's gain dominates the wife's) imposes an externality on the tied mover or stayer, but this externality is assumed to be internalized within the family through transfers or altruistic utility. Estimating the probability of migrating on the basis of individual gains for someone who makes decisions on the basis of family gains will bias the estimation results. Using a Becker (1974) marriage model, Mincer shows that this divergence between individual and family interests due to migration opportunities may contribute to family (or marriage) instability because it is more likely that the net gain from remaining in the family is negative.

Bargaining models of the family emphasize the effect of migration on the relative bargaining power of different family members (Johnson, 1993, and Lundberg and Pollak, 1994). A move which raises the income for the father and the family as a whole may reduce the access to resources by the mother and the children if the mother's bargaining power is reduced because she loses access to alternative means of support.

Stark and Levhari (1982) show that migration of a family member can serve as insurance when income fluctuations for the family and the migrant are uncorrelated or negatively correlated (a sort of geographical diversification). Stark and Lucas (1988)

[9] This assumes a completely altruistic family or one ruled by a benevolent dictator. See Sen (1983).

describe migration as an implicit contract where the family finances the migrant's move in return for future remittances. Moral hazard on the part of the migrant, who wants to retain ties to his village, is controlled through property bequests, social standing in the home village, or the promise of family support for the migrant in hard times.

Stark (1984) suggested that relative deprivation is a motivation to migrate when the family can improve its relative income standing elsewhere, even when it doesn't improve its income (this is not exclusively a family issue). Stark and Taylor (1989) find evidence for this in Mexico.

VI. Information and Networks

The flow of information has been considered important for migration before it was an important concern for the rest of economics. For instance, Nelson (1959) pointed out that family and friends who have previously migrated provide important information about their destination to subsequent migrants. Relatives and friends often provide food and lodging to the new migrant until he or she can find a job, and they can make the social transition easier. If migrants are more likely to move to locations where they have more contacts, past migration will encourage subsequent migration. There are increasing returns to scale in migration to a particular destination because of personal contacts. Empirically, past migration of family and friends is found to influence current migration.[10]

Although the role of information and contact networks in migration has been recognized, there has been little formal modeling of it. Taylor (1986) is an exception (so are some search models, below). He models the subjective return to migration as:

$$V = \overline{V}(net) + \sigma(net)\varepsilon$$

where V = migrant's (subjective) net returns from moving

$\overline{V}(net)$ = mean of V as a function of the migrant's network (*net*) of contacts[11]

$\sigma(net)$ = standard deviation of V as a function of the migrant's network

ε = a random error term with mean zero and variance equal to one.

Since Taylor assumes migrants are risk-averse, they care not only about the average return to migration, but also its variance. The migrant's network may reduce the migrant's *ex ante* subjective variance of returns with information about the destination as well as the *ex post* actual variance of migration returns with material help.

---

[10] See Greenwood (1975), p.405.

[11] Taylor found in his sample of Mexican immigrants to the U.S. and to other parts of Mexico that previous contacts did not seem to affect the mean earnings of the migrants, and so he did not make the mean of V a function of the migrant's network, although he noted that it could be.

VII. Search Models of Migration

Search theory describes the optimal search for the highest wage from a distribution of wage offers known to the migrant. Stigler (1961,1962) developed search theory in economics (his 1962 paper is in the same journal issue as Sjaastad). In his model job searchers draw wages from a known distribution of wages and incur a cost for each draw (the cost of obtaining a wage offer). Stigler derives the optimal number of draws such that the searcher maximizes the maximum wage drawn less the cost of the wage draws. The optimal number of draws is a function of the distribution of wages and the cost of the draws.

If the searcher can observe the result of each draw before deciding to draw another (a sequential search), however, it is not optimal to decide upon a fixed sample size of wage offers before beginning the search. Suppose the searcher draws the maximum wage in the wage distribution on the first draw. Since the searcher knows the wage distribution, it would never be optimal for the searcher to draw another wage as long as draws have a positive cost. Optimal searchers will instead decide upon a 'reservation wage' below which they will reject subsequent wage offers, and above which they will accept a wage offer and end their search. The reservation wage will be a function of the distribution of wage offers and the cost of searching. Economists applied the results from the optimal stopping literature in statistics to make optimal sequential models of search in the early 1970s (e.g. McCall, 1970, and Mortensen, 1970 - for an excellent survey, see Mortensen, 1986).

David (1974) first applied the theory of job search to migration, giving Todaro's expected income model a more realistic representation of how migrants find jobs after they move, and converting the decision model to a more general expected utility maximization. David uses Stigler's non-optimal search model. He emphasized the implications of the main counterintuitive result of job search models: risk-neutral searchers like dispersion in the wage distribution over which they search - they behave like risk lovers. This is most easily seen in the sequential search model.[12] The wage offers searchers are willing to accept are those in the wage offer distribution after it has been truncated on the left, at the reservation wage, w* (see Figure 1).

---

[12] In Stigler's optimal sample size model, the risk-neutral searcher likes risky wage distributions because the searcher chooses the maximum of the sampled wage offers. The expected value of the *maximum* sampled wages increases as the dispersion of the distribution of wages increases.

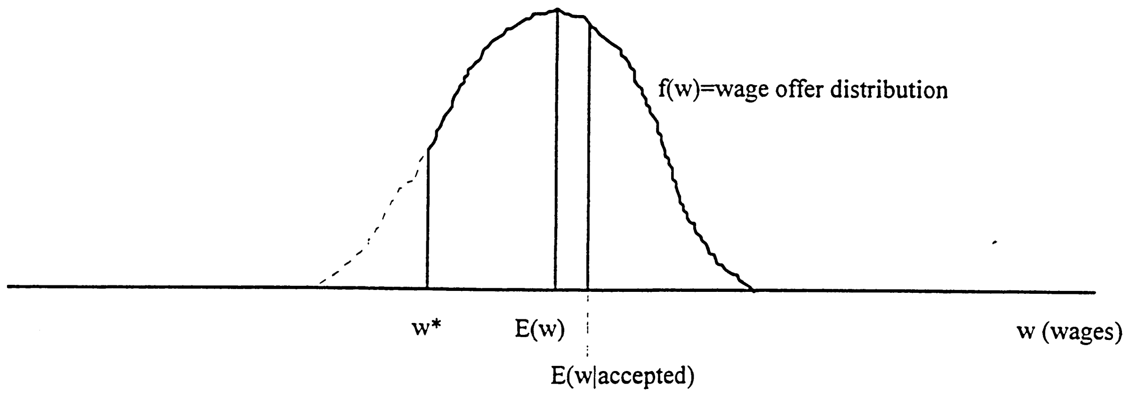

FIGURE 1 DISTRIBUTION OF WAGE OFFERS

The mean wage accepted, E(w|accepted), is greater than the mean wage offered, E(w). If the dispersion of the wage offer distribution increases (risk increases), it can be shown that the reservation wage will fall, from w1* to w2*, but the mean accepted wage will still rise, from E(w1|accepted) to E(w2|accepted) (see Figure 2).[13]

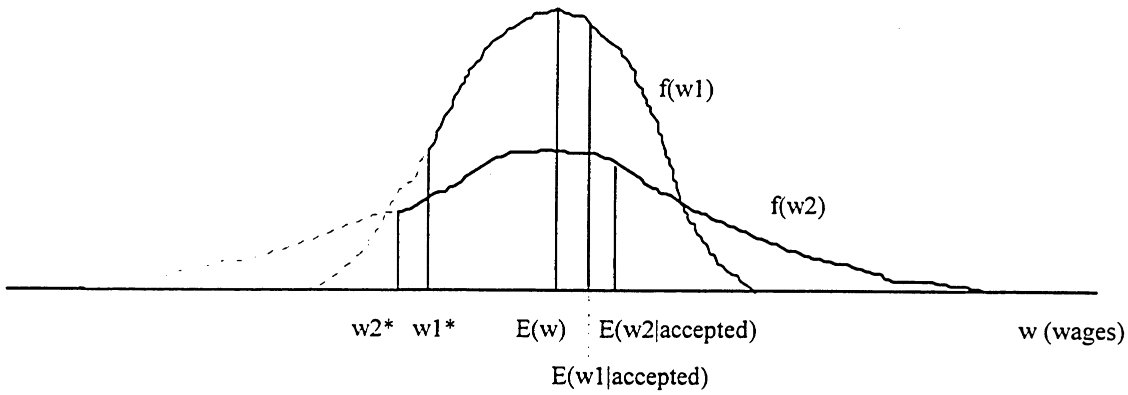

FIGURE 2 WAGE DISTRIBUTIONS WITH DIFFERENT VARIANCES

Since the risk-neutral searcher cares only about the mean accepted wage, she will prefer a risky wage offer distribution because she will ignore the more frequent very low wage offers, but take advantage of the also more frequent very high wage offers. The risk-averse searcher, however, cares also about the dispersion of wages he would accept.

David personified the trade-off between a higher mean accepted wage and a more variable wage as the struggle between Fortune and Risk. Fortune pulls the migrant towards a risky job market with the prospect of some very high wages and no obligation to take low wages, while Risk warns that even acceptable wages are very unpredictable in a risky market and urges the migrant towards the sure thing. I will not show David's model here because he uses an outdated search method in a migration model with

---

13 For the derivation, see Sargent (1987), p.17.

baroque ornamentation, but he combines job search, risk aversion, and wealth constraints on the migration investment, any two of which have which have not been combined in a migration model since.

After David, the application of search theory to migration problems seems to have been forgotten for fifteen years.[14] Vishwanath (1991) applies an updated optimal job search to the expected income migration model. Individuals maximize the discounted present value of expected income over their infinite lifetime (for mathematical tractability). The difference between this and Todaro is that the present value of migrating to the city is determined according to an optimal sequential search for a job.

For the purposes of comparison, I will rewrite Todaro's expected income model in continuous time with an infinite time horizon. As before, y_r is the fixed real rural income, y_u is the fixed real urban income, and C_0 is the cost of moving. The subjective rate of discount is δ,[15] V_r is the present discounted value of working in the rural area, V_u is the present discounted value of working in the urban area, and *p(t)* is the probability of being employed in urban sector at time *t*. *p(t)* increases with time.

$$V_r = \int_0^{\infty} y_r \, e^{-\delta t} dt = \frac{y_r}{\delta}$$

$$V_u = \int_0^{\infty} y_u \, p(t) \, e^{-\delta t} dt$$

The rural worker will migrate if $V_0 \equiv V_u - V_r - C_0 > 0$.

In Vishwanath's model, V_r remains the same as in Todaro's.[16] V_u is different because of the job search.

$$V_u = \int_0^{\infty} E[y_u^*(t)] \, e^{-\delta t} dt$$

where $E[\cdot]$ is the expectation operator, and $y_u^*(t)$ is urban income in time *t* chosen by optimal job search. The urban job searcher receives job offers according to a Poisson process at rate γ per instant, while incurring a cost of search of *c* per instant. The job offers come from a distribution *F(w)* on a support $[\underline{w}, \overline{w}]$. V_u is implicitly defined by a stochastic Bellman equation over the short time interval [*t*, *t*+*dt*]:

$$V_u = -c\,dt + (1-\delta\,dt)\gamma\,dt \int_{\underline{w}}^{\overline{w}} \max[V(w), V_u]\, dF(w) + (1-\delta\,dt)(1-\gamma\,dt)V_u + o(dt)$$

---

[14] Harris and Sabot (1982), written for a 1976 conference, is an exception. They use the general ideas of search theory to give a more realistic elaboration of the probability of getting a job (π_t) than that in Todaro (1969). They make no mention of David, though.

[15] If δ were the rate of discount for discreet time, then $\beta = 1/(1-\delta)$ where β is the rate of time preference as in Todaro's model.

[16] Vishwanath also allows for a rural-based search in the urban labor market, as discussed by Fields (1975), but I ignore this to simplify the presentation.

The first term on the right hand side of the equation above is the cost of searching during the short time interval. The probability of receiving a wage offer in the interval is $\gamma\, dt + o(dt)$, where $o(dt)$ represents a term which approaches zero as dt approaches zero. The wage offer is received at the end of the interval, so it is discounted back to time t by $e^{-\delta\, dt} = 1 - \delta\, dt + o(dt)$. The offer is accepted or rejected according to whether the value of taking the job is greater or less than the value of continuing to search. The value of taking a job with wage w is $V(w)$. The value of continuing to search is V_u. So the second term in the equation is the discount factor times the probability of getting a wage offer times the expected value of that wage depending on whether it is accepted or rejected. The third term is the probability of not getting a wage offer times the value of continuing to search. The Bellman equation above can be manipulated to get:

$$V_u = -\frac{c}{\delta} + \frac{\gamma}{\delta} \int_{\underline{w}}^{\overline{w}} \max[V(w) - V_u, 0]\, dF(w)$$

As before, a rural-dweller will migrate if $V_0 \equiv V_u - V_r - C_0 > 0$, where C_0 = money and non-money costs of migration.

Besides providing a more compelling description of the manner in which migrants search for jobs in the urban market, Vishwanath captures the impact of migrant information networks and intensity of job search in γ, the job offer arrival rate. Job seekers with good contacts and determination will have a higher γ which will induce them to migrate. Vishwanath also shows that the average urban wage can be below the rural wage, but still induce migration. This is because of the central characteristic of job search models: workers can refuse bad wage offers, so they tend to seek out the risky urban environment.

Vishwanath's model is subject to several of the same criticisms as Todaro's. Although the job search in the urban market is an optimal dynamic process, the migration decision itself is not - it is considered at one point in time, with no anticipation of future moves. The job search model is in terms of expected income, not expected utility, which highlights the paradoxical theoretical conclusion of search theory: risk-neutral searchers will behave like risk lovers. Among destinations with the same average wage offer, search theory predicts that the risk-neutral migrants should also seek out the riskiest possible destination. However, most people are risk-averse, and this is likely to dominate the search-induced attraction to risky environments (see Gallup, 1994 for some evidence in Malaysia).

Following Todaro's progression from a model focusing on the migration decision to Harris and Todaro's simple general equilibrium model of the relationship between unemployment and migration, Vishwanath (1991a) has a general equilibrium treatment of rural-urban migration in a job-search framework. By abandoning Todaro's assumption of a fixed non-market-clearing urban wage, and allowing for a rural-based search, Vishwanath shows that urban job creation may or may not cause an increase in urban unemployment, depending on the magnitude of different parameters. Job seekers can remain in the rural area and search for urban jobs, but the efficiency of their search is less than urban-based job seekers. The alternative to getting a job for urban-based job seekers is the "non-employment" reservation wage in the informal sector, b. An increase in urban labor demand can *decrease* urban non-employment if the higher wage offered for formal sector employment reduces the reservation wage of those searching from the informal sector sufficiently to make rural-based search more attractive than urban informal-sector-based search. The higher formal sector wage makes job searchers willing to accept a lower wage b while queuing in the informal sector, but this makes village-based search more attractive, resulting in a smaller informal sector.[17]

VIII. Imperfect Information, Dynamics, and Repeat Migration

All of the previous models assumed that migrants anticipated moving to a new location for good. Consider, however, migrants who move more than once. They fall into two groups: those who anticipated moving on, and those who planned to move only once, but changed their minds. To capture the decisions of migrants who planned to move again, it is necessary to incorporate their anticipation of future moves into their original decision to move. For migrants who changed their minds after they moved, one must incorporate their misperceptions about their prospects before they moved.

From Todaro up through search models of migration, a basic insight has been that migrants don't know precisely what they will find at the destination before they move. They *are* assumed, though, to know the precise distribution of random opportunities in each location. There are no mistakes, and there is no learning. Migrants may be unlucky and get a bad draw from the random distribution, but they are not ill-informed. Once people have moved, there is no reason within the models for them to move again, since they know it is just a matter of time until they find a job they like.

The importance of incorporating the more realistic imperfect information and the dynamics of learning is clearest when studying return migration. If the migrant knows just as much about a location before moving as after, there is no reason for return migration within the simple income maximization framework. Early work in return migration was largely empirical with little formal theory.[18] More recently, some very formal theory has been applied to the problem of uncertainty about the characteristics of locations for migration. Maier (1985) and McCall and McCall (1987) were the first papers in this area, but Berninghaus and Seifert-Vogt (1991), provide a more general model and a clearer presentation.[19]

---

[17] It seems counter-intuitive that with *fewer* informal sector workers, the informal sector wage can go down, but that is because the informal sector workers (the "non-employed") are paid their reservation wages, i.e. the informal sector labor is monopsonistic while the formal sector is competitive. Whether this labor market structure is plausible is an empirical question.

[18] See Yezer and Thurstone (1976), Allen (1979), Da Vanzo (1983), Hertzog and Schlottmann (1983), and Hertzog *et al.* (1985).

[19] See also El-Gamal (1993), Pessino (1991), and Bhattacharya (1990).

The problem facing the migrant is to choose the location that maximizes expected utility subject to *imperfect* knowledge of each location's characteristics. The expected value of moving to a location is thus conditioned on the state of the migrant's knowledge at the time of the decision. The model falls within the class of multi-armed bandit (MAB) problems in statistics by analogy with the problem of deciding the best way to play a slot machine with multiple levers ("arms") each having unknown payoffs. In their general form, MAB problems are analytically intractable. Under certain assumptions, though, use of the "Gittens Index" simplifies the solution to MAB problems. Choosing the location with the highest Gittens Index solves the general dynamic programming problem, and since the index depends only on expected future returns in a given location rather than expected future returns in all locations, its use dramatically reduces the dimension of the solution.

Some of the assumptions necessary to apply the Gittens Index are not ideal for the context of migration, but the assumptions are nevertheless considerably less restrictive than those needed for the earlier models reviewed here. First, as in the previous models, the characteristics of locations must not change over time. Second, the cost of moving to a particular location must only occur once, the first time the migrant moves to that location. This may be justified if the main costs of moving are the time and money costs of adjusting to life in a new location, and this knowledge is not forgotten. Observed transportation costs for migrants are typically quite small (Greenwood, 1975). Third, the migrant can only learn about a location by moving there.

Berninghaus and Seifert-Vogt simplify the presentation of their model with further assumptions which could be relaxed. Income and other utility in each location are assumed fixed, though initially unknown to the migrant. The costs of moving are known, and utility is linear in income, other utility, and moving costs.

The migrant's experience is as follows. First, she decides which location has the best prospects (in the manner explained below). If it is different from her current location and she has not lived there before, then she incurs moving costs c_k and observes income y_k which was previously unknown. Her utility $u_k(move)$ is $y_k - c_k$. In the next period, she also observes her "other utility" at the new location, ϕ_k, so her utility $u_k(stay)$ is $y_k + \phi_k$. From then on, she receives utility $y_k + \phi_k$ until she decides to move again.

The decision to move is made by choosing the location with highest expected utility. Since the income y_k and other utility ϕ_k are imperfectly known in the locations not yet explored, the migrant bases her decision on her subjective probability distributions over y_k and ϕ_k, denoted by $F_k(y)$ and $G_k(\phi)$. With this information, the migrant can calculate her expected discounted utility for every possible migration path, and choose the best one. Note that this is the subjective expectation, since actual wages and other utility are fixed for the migrant in each location. The best path is reassessed each period as the migrant learns about actual opportunities in different locations by moving there.

Berninghaus and Seifert-Vogt derive the following implications:

1. Return migration may be a rational response when the migrant is disappointed by the wage or other utility at the destination.[20]

2. A location becomes more attractive the *less* information the migrant has about income and other utility there.

This paradoxical result is similar in concept, but distinct from the search-theoretic attraction to locations with high variance in opportunities. Here, actual opportunities are fixed, but the less is known about a location, the greater the subjective probability of both very good and very bad outcomes. Only the good opportunities need be accepted, since the migrant can move on to other locations if the actual opportunities are worse than expected. This result, like the search theory result, is only necessarily true for risk neutral migrants, but Berninghaus and Seifert-Vogt show that risk-averse migrants are also attracted to locations know less about, for "small" amounts of risk aversion. More risk-averse migrants prefer locations they know well.

3. Locations with high outmigration also have high inmigration.

The model predicts this "law of migration" of Ravenstein[21] when migrants are attracted to a location they know little about, because a large percentage of them are likely to be disappointed and return home.

A model of migration decision-making that incorporates migrants' imperfect information about opportunities in different locations is attractive, especially for considering dynamic issues. Even with the simplifying assumptions described above, though, MAB models are complex which has deterred their empirical application. Although the assumptions on which they are based are more general than in most previous work, the assumptions needed for tractability are not entirely consistent with migration behavior. In particular, the assumption that information about opportunities in other locations can only be attained by moving there does not jibe with the idiosyncratic arrival of information to migrants by way of family, friends, and chance.

---

[20] Another reason for return migration, that migrants move in order to accumulate savings they take back home to consume. is not part of this model because there are no savings. Berninghaus and Seifert-Vogt also present an interesting model with savings (not discussed here) that formalizes Piore's (1979) hypothesis that migrants stay at their destination longer than they originally intended becuase they fail to attain their target level of savings.

[21] Ravenstein's (1887) "laws of migration" have been remarkably well validated for different periods and countries, but they were criticized even at the time of their presentation as being empirical regularities rather than laws justified by any theory (see Royal Statistical Society member comments on Ravenstein's paper).

IX. A General Framework

Most of the models of migration above fit within the framework of maximization of expected utility over a choice of locations. In this section, a general expected utility model of migration is presented, and successive restrictions on its form leads to the migration models already discussed.

At time t, the individual chooses a sequence of possible future locations $k_s \in \{1,\ldots,L\}$ in time $s \in \{t,\ldots T\}$ that solve

$$\max_{\{k_t,\ldots,k_T\}} E\{U[(y_{kt},c_{kt},\phi_{kt}),\ldots,(y_{kT},c_{kT},\phi_{kT})]|\Omega(t)\} \quad (1)$$

$E\{\cdot|\Omega(t)\}$ is the expectation conditional on the individual's information and beliefs at time t, $\Omega(t)$. $U[\cdot]$ is the indirect utility of the individual's future experience, and the triplet $(y_{ks},c_{ks},\phi_{ks})$ is made up of the individual's income at location k at time s, y_{ks}, the cost of moving to location k, c_{ks}, and a vector of other factors which affect utility of location k, ϕ_{ks}. $c_{ks}=0$ if $k_s = k_{s-1}$. T is the last period the individual could still be living, or a time sufficiently far in the future that it doesn't affect current decisions.

In the present, at time t, the migrant goes to the location k_t that is part of his or her expected utility maximizing path $\{k_t,\ldots,k_T\}$.[22] Location k_t is optimal given that the migrant anticipates being in locations $\{k_{t+1},\ldots,k_T\}$ in the future, and given what he knows now, $\Omega(t)$. The migrant may not end up going to locations $\{k_{t+1},\ldots,k_T\}$ if his knowledge, or the world, changes, but they are the best anticipated choices at the present. Migration occurs if $k_t \neq k_{t-1}$.

This framework, though very general, still implies restrictions on the migrant's behavior. It implies the migrant can form a subjective assessment of all possible locations, at least well enough to choose the best location for him, given his beliefs. It does not imply his beliefs are accurate, however. The decision can be interpreted as an individual decision, or a unitary family decision, so it is consistent with simple family migration decision making as in Mincer (1978), but it is not consistent with more realistic interdependent family decisions, such as in bargaining models of the family. Modeling the formation of family decisions is still not very well developed (see Lundberg and Pollak, 1994).

The framework is progressively restricted to give us the simplified forms used in the models discussed above. The first restriction is to replace the utility function $U[\cdot]$ with a discounted per-period utility, $u(\cdot)$:

$$E\{U[(y_{kt},c_{kt},\phi_{kt}),\ldots,(y_{kT},c_{kT},\phi_{kT})]|\Omega(t)\} = \sum_{s=t}^{T} E\{\beta_s u(y_{ks},c_{ks},\phi_{ks})|\Omega(t)\}.$$

β_s is the subjective discount factor of future utility, where $0<\beta_s<1$. It may be affected by the individual's expectation of survival. T can be chosen so that $E(\beta_T)=0$ because the individual knows he will not survive to period T. The most important consequence of this change is that it implies that the migrants don't save money. Since there are no assets

---

22 "Migrant" refers to the individual making decisions whether or not he decides to move.

in the model and current income only affects current utility, individuals must consume their current income in each period.

If $\beta_s = \beta^s$ and $u(y_{ks}, c_{ks}, \phi_{ks}) = y_k - c_k + \phi_k$, we have the model used Berninghaus and Seifert-Vogt (1991):

$$\max_{\{k_t,\dots,k_T\}} \sum_{s=t}^{T} \beta^s E\{u(y_{ks}, c_{ks}, \phi_{ks}) | \Omega(t)\} \qquad (2)$$

The per-period discount rate, β, where 0<β<1, is constant over time. As before, the migrant assesses whether he would do better by staying or moving in each future period given his beliefs, and then incorporates his expected future moves into the decision of whether to move now. Berninghaus and Seifert-Vogt emphasize that migrants have a motive to sacrifice some early payoff to gather information (embodied in Ω(t)) to allow more informed choices later.

The other models of migration discussed here incorporate two important additional restrictions. The first is that migrants' beliefs about the distribution of their opportunities are correct and do not change over time. The second restriction is that migrants anticipate moving for good; they don't incorporate possible future moves, such as return moves, into their decision to move or stay in the present. Only the current move would enter into the migrant's decision if he really does plan to move for good, or if anticipated subsequent moves are far enough in the future that they do not affect the payoff from moving in the present.

The representation of the expected utility maximization looks similar to Equation 2:

$$\max_{k_t} \sum_{s=t}^{T} \beta^s E\{u(y_{ks}, c_{ks}, \phi_{ks})\} \qquad (3)$$

The differences are that the expected utility is not conditional on the migrants' beliefs, and the migrant maximizes only with respect to the current location, k_t, because the migrant anticipates staying there until time T.

Vishwanath (1991) and Todaro(1969) both use highly restricted versions of Equation 3. They restrict their analysis to two regions, urban and rural (u and r), and in the rural region, income in fixed: $E\{u(y_{rs}, c_{rs}, \phi_{rs})\} = y_r$. In the urban region, Todaro assumes that income is also constant, but the migrant has only a probability $p_s < 1$ of getting a job: $E\{u(y_{us}, c_{us}, \phi_{us})\} = p_s y_u - c_s$. In Vishwanath, there is a random distribution of urban wages, but once a job is accepted on the basis of optimal search, its wage is constant: $E\{u(y_{us}, c_{us}, \phi_{us})\} = Ey_{us} - c_s$.

Mincer's (1978) and Stark's (1991) family migration models can be represented by Equation 3 when the utility function $u(\cdot)$ is reinterpreted as the family's rather than the individual's utility. Family risk aversion, which is important in several of Stark's models, is captured by the expected *utility* of income instead of simple expected income.

Sjaastad (1962) treats income as fixed and nonrandom in all locations, so Equation 3 applies with $E\{u(y_{ks}, c_{ks}, \phi_{ks})\} = y_k + \phi_k - c_k$. c_k includes psychic as well as monetary costs of moving.

Most of the models reviewed here fit directly into the general expected utility decision framework, as special cases. The progression of theoretical work on migration decision-making considered here has been from more restricted to more general forms of this framework.

References

Allen, Jeremiah (1979). "Information and subsequent migration: Further analysis of and additional evidence," Southern Economic Journal 45:1274-1284, April.

Anton, John J. (1980). "Returns to migration: Literature review and critique," RAND Note N-1480-NICHD.

Banerjee, Biswajit (1991). "The determinants of migrating with a pre-arranged job and of the initial duration of urban unemployment: An analysis based on Indian data on rural-to-urban migrants," *Journal of Development Economics* 36(2):337-351.

Becker, Gary S. (1974). "A theory of marriage," In *The Economics of the Family: Marriage, Children, and Human Capital*, edited by T. W. Schultz, Chicago: University of Chicago Press.

Berninghaus, Siefried, and Hans Günther Siefert-Vogt (1991). *International Migration Under Incomplete Information: A Microeconomic Approach*. Berlin: Springer-Verlag.

Bhattacharya, Gautam (1990). "Migration under uncertainty about quality of locations," *Journal of Economic Dynamics and Control*, 14:721-739.

Borjas, George J. (1994). "The Economics of Immigration," *Journal of Economic Literature* 32:1667-1717.

Carey, H. C. (1858-59). *Principles of Social Science*. Philadelphia: J. B. Lippincott, 3 vols.

Carrothers, Gerald A. P. (1956). "An historical review of the gravity and potential concepts of human interaction," *Journal of the American Institute of Planners*, 22(2):94-102.

Corden, W. Max, and Ronald Findlay (1975). "Urban unemployment, intersectoral capital mobility and development policy," *Economica* 42:59-78, February.

David, Paul A. (1970). "Fortune, risk and the microeconomics of migration," in Paul A. David and Melvin W. Reder, eds., *Nations and Households in Economic Growth: Essays in Honor of Moses Abramovitz*, New York: Academic Press.

Da Vanzo, Julie (1983). "Repeat migration in the United States: Who moves back and who moves on?" *Review of Economics and Statistics* 65:552-559.

Danforth, John P. (1979). "On the role of consumption and decreasing absolute risk aversion in the theory of job search," in Steven A. Lippman and John J. McCall, eds., *Studies in the Economics of Search*, Amsterdam: North Holland, pp. 109-131.

De Jong, Gordon F., and R.W. Gardner, eds. (1981). *Migration Decision Making: Multidisciplinary Approaches to Micro-Level Studies in Developing Countries*. Pergamon Press.

El-Gamal, Mahmoud A. (1993). "A dynamic migration model with uncertainty," California Institute of Technology Social Science Working Paper no. 843, March.

Fields, Gary S. (1975). "Rural-urban migration, urban unemployment and underemployment, and job-search activity in LDCs," *Journal of Development Economics*, 2:165-187.

Gallup, John Luke (1994). "Migration in Malaysia: Heterogeneity and persistence," manuscript, Institutes of Economics and Sociology, Hanoi, Vietnam. October.

Greenwood, Michael J. (1975). "Research on internal migration in the United States: A survey," *Journal of Economic Literature*, 13:397-433.

Greenwood, Michael J. (Forthcoming). "Internal migration in developed countries," in Handbook of Population and Family Economics. Amsterdam: Elsevier Science.

Harris, John R., and Richard H. Sabot (1982). "Urban unemployment in LDCs: Towards a more general search model," in Richard H. Sabot, ed., *Migration and the Labor Market in Developing Countries*, Boulder, Colorado: Westview Press.

Harris, John R., and Michael P. Todaro (1970). "Migration, unemployment and development: A two-sector analysis," *American Economic Review*, March, 60:126-142.

Hertzog, Henry W., Jr., and Alan M. Schlottmann (1983). "Migrant information, job search and the remigration decision," *Southern Economic Journal* 50:43-56, July.

Hertzog, Henry W., Jr., Richard A. Hofler, and Alan M. Schlottmann (1985) "Life on the frontier: migrant information, earnings and past mobility," *Review of Economics and Statistics* 67(3):373-382, August.

Johnson, Jeff (1993). "Game theoretic models of the family," mimeo, Department of Economics, University of California at Berkeley.

Lucas, Robert E. B. (Forthcoming). "Internal migration in developing countries," in *Handbook of Population and Family Economics.* Amsterdam: Elsevier Science.

Lundberg, Shelly, and Robert Pollak A. (1994). "Noncooperative bargaining models of marriage," *American Economic Review* 84(2):132-37, May.

Maier, G. (1985). "Cumulative causation and selectivity in labor market oriented migration caused by imperfect information," *Regional Studies* 19:231-241.

Massey, Douglas S., Joaquín Arango, Graeme Hugo, Ali Kouaouci, Adela Pellegrino, and J. Edward Taylor (1993). "Theories of International Migration: A Review and Appraisal," *Population and Development Review*, 19(3):431-466, September.

Massey, Douglas S., Joaquín Arango, Graeme Hugo, Ali Kouaouci, Adela Pellegrino, and J. Edward Taylor (1994). "An Evaluation of international migration theory: The North American case," *Population and Development Review* 20(4):699-751, December.

Mazumdar, Dipak (1987). "Rural-urban migration in dveloping countries," in E.S. Mills, ed., *Handbook of Regional and Urban Economics.* Amsterdam: Elsevier Science.

McCall, Brian P., and John J. McCall (1987). "A sequential study of migration and job search," *Journal of Labor Economics*, 5(4):452-476.

McCall, John J. (1970). "Economics of information and job search," *Quarterly Journal of Economics*, 84:113-126.

Mincer, Jacob (1978). "Family migration decisions," *Journal of Political Economy*, 86(5):749-773.

Molho, Ian (1986). "Theories of Migration: A Review," *Scottish Journal of Political Economy*, 33(4):396-419.

Mortensen, Dale T. (1970). "Job search, the duration of unemployment, and the Phillips curve," *American Economic Review*, 60:505-517.

Mortensen, Dale T. (1986) "Job search and labor market analysis," in O. Ashenfelter and R. Layard, eds., *Handbook of Labor Economics*, Vol. 2, Chap. 15, pp. 849-919.

Nelson, P. (1959). "Migration, Real Income, and Information," *Journal of Regional Science*, Spring, 1(2):43-74.

Pessino, Carola (1991). "Sequential Migration Theory and Evidence from Peru," *Journal of Development Economics* 36(1):55-87.

Piore, Michael (1979). *Birds of Passage.* New York: Columbia University Press.

Ravenstein, E.G. (1885). "The Laws of Migration," *Proceedings of the Royal Statistical Society.*, XLVII(2):167-235, June.

Sargent, Thomas (1987). *Dynamic Macroeconomics*, Cambridge, Mass.: Harvard University Press.

Schultz, T. Paul (1982). "Lifetime Migration within Educational Strata, in Venezuela: Estimates of a Logistic Model," *Economic Development and Cultural Change*, 30(3):559-593, April.

Schultz, T. Paul (1982a). "Notes on the Estimation of Migration Decision Functions," in Richard H. Sabot, ed., *Migration and the Labor Market in Developing Countries*, Boulder, Colorado: Westview Press.

Sen, Amartya K. (1983). "Economics and the Family," in *Resources, Values and Development*, Cambridge, Mass.: Harvard University Press, pp. 369-388.

Sjaastad, Larry A. (1962). "The costs and returns of human migration," *Journal of Political Economy*, 70:80-93.

Stark, Oded (1984). "Rural-to-urban migration in LDCs: A relative deprivation approach," *Economic Development and Cultural Change*, April, 32(3):475-86.

Stark, Oded (1991). *The Migration of Labor.* Cambridge, Massachusetts: Basil Blackwell.

Stark, Oded, and D. Levhari (1982). "On migration and risk in LDCs," *Economic Development and Cultural Change*, 31(1).

Stark, Oded, and Robert E. B. Lucas (1988). "Migration, Remittances, and the Family," *Economic Development and Cultural Change*, 465-481.

Stark, Oded, and Taylor, J. Edward (1989). "Relative deprivation and international migration," *Demography*, February, 26(1):1-14.

Stigler, George (1961). "The economics of information," *Journal of Political Economy* 69(3):213-225.

Stigler, George (1962). "Information in the labor market," *Journal of Political Economy* 70:94-104.

Taylor, J. Edward (1986). "Differential migration, networks, information and risk," *Migration, Human Capital and Development: Research in Human Capital and Development, Vol. 4*, Greenwich, Conn.: JAI Press.

Todaro, Michael P. (1969). "A model of labor migration and urban unemployment in less developed countries," *American Economic Review*, March, 59(1):138-148.

Todaro, Michael P. (1980). "Internal migration in developing countries: A survey," in Richard A. Easterlin, ed., *Population and Economic Change in Developing Countries*, Chicago: University of Chicago Press, pp. 361-402.

Vishwanath, Tara (1991). "Information flow, job search, and migration," *Journal of Development Economics* .

Vishwanath, Tara (1991a). "Rural-urban migration: an equilibrium analysis," mimeo, Northwestern University, August.

Williamson, Jeffrey G. (1988). "Migration and Urbanization," in Hollis Chenery and T.N. Srinivasan, eds., *Handbook of Development Economics*, Amsterdam: North Holland, pp. 426-61.

Yap, Lorene Y. L. (1977). "The Attraction of Cities: A Review of the Migration Literature," *Journal of Development Economics*, 4:239-264.

Yezer, Anthony M. J., and Lawrence Thurstone (1976). "Migration patterns and income change: Implications of the human capital approach to migration," Southern Economic Journal 42:693-702, April.

HIID's most recent Development Discussion Papers (DDPs)

568. Jeffrey D. Sachs. "Alternative Approaches to Financial Crises in Emerging Markets." January 1997. 20 pp.

567. Jeffrey R. Vincent and Theodore Panayotou. "Consumption and Sustainable Development." January 1997. 11 pp.

566. Tianlun Jian. "Priority of Privatization in Economic Reforms: China and Taiwan Compared with Russia." December 1996. 18 pp.

565. Katharina Pistor and Andrew Spicer. "Investment Funds in Mass Privatization and Beyond: Evidence from the Czech Republic and Russia." December 1996. 37 pp.

564. Nirupam Bajpai and Tianlun Jian. "Reform Strategies of China and India: Suggestions for Future Actions." December 1996. 22 pp.

563. Donald J. Robbins. "Stolper-Samuelson (Lost) in the Tropics? Trade Liberalization and Wages in Colombia: 1976-1994." December 1996. 42 pp.

562. Pauline E. Peters. "Failed Magic or Social Context? Market Liberalization and the Rural Poor in Malawi." November 1996. 37 pp.

561. Joseph Stern and Mary Kay Gugerty. "Structural Barriers to Trade in Africa." November 1996. 46 pp.

560. Daniel Kaufmann and Stephen A. O'Connell. "The Macroeconomics of Delayed Exchange Rate Unification: Theory and Evidence from Tanzania." November 1996. 33 pp.

559. Sudhir Anand and Jonathan Morduch. "Poverty and the Population Problem: Evidence from Bangladesh." November 1996. 28 pp.

558. Daniel Kaufmann and Aleksander Kaliberda. "An 'Unofficial' Analysis of Economies in Transition; An Empirical Framework and Lessons for Policy." October 1996. 40 pp.

557. Donald J. Robbins. "HOS Hits Facts: Facts Win; Evidence on Trade and Wages in the Developing World." October 1996. 55 pp.

556. Seth Terkper. "Vat in Ghana: Why it Failed." October 1996. 35 pp. *Reprint Series*.

555. John M. Cohen and Stephen B. Peterson. "Methodological Issues in the Analysis of Decentralization." October 1996. 24 pp.

554. Yana van der Meulen Rodgers and Joseph E. Zveglich, Jr. "The Impact of Protective Measures for Female Workers: Some Evidence from Taiwan." September 1996. 45 pp.

553. Ashish Garg and Jonathan Morduch. "Sibling Rivalry, Resource Constraints, and the Health of Children: Evidence from Ghana." September 1996. 35 pp.

552. Jeffrey D. Sachs and Andrew M. Warner. "Economic Reform and the Process of Global Integration." September 1996. *Reprint Series*.

551. Donald R. Davis. "Trade Liberalization and Income Distribution." September 1996. 9 pp.

550. Donald R. Davis. "Does European Unemployment Prop Up American Wages?" September 1996. 18 pp.

549. Donald R. Davis. "Technology, Unemployment, and Relative Wages in a Global Economy." September 1996. 15pp.

HIID's most recent Development Discussion Papers (DDPs)

548. Charles Goodhart and Chenggang Xu. "The Rise of China as an Economic Power." September 1996. 89 pp.

547. Donald R. Snodgrass. "Education in East Asian Development: Some Issues and Cases." August 1996. 38 pp.

546. Michael Roemer and Chou Ji. "The Economic Development of Taiwan, 1980 to 1993 Macroeconomic Policy: Overzealous or Inflexible?" July 1996. 31 pp.

545. Jeffrey D. Sachs and Andrew M. Warner. "Sources of Slow Growth in African Economies." July 1996. 12 pp.

544. Jeffrey D. Sachs and Andrew M. Warner. "Achieving Rapid Growth in the Transition Economies of Central Europe." July 1996. 68 pp.

543. Michael Roemer. "Could Asian Policies Propel African Growth?" July 1996. 17 pp.

542. Jeffrey R. Vincent. "Resource Depletion and Economic Sustainability in Malaysia." July 1996. 29 pp.

541. Graham Glenday. "Basic World Tax Code: In Sub-Saharan Africa, Does it Fit The Bill?" May 1996. 16 pp. *Taxation Research Series No. 27.*

540. Ricardo Godoy, Jeffrey R. Franks, David Wilkie, Mario Alvarado, George Gray-Molina, Raul Roca, Jario Escóbar, and Marina Càardenas. "The effects of Economic Development on Neotropical Deforestation: Household and Village Evidence from Amerindians in Bolivia." May 1996. 41pp.

539. Ricardo Godoy, Jeffrey R. Franks and Mario Alvardo Claudio. " Adoption of Modern Agricultural Technologies by Lowland Amerindians in Bolivia: The Role of Household, Villages, Ethnicity, and Markets." May 1996. 28pp.

538. Charles I. Jones and John C. Williams. "Too Much of a Good Thing? The Economics of Investment in R & D." May 1996. 47pp. *Conference Paper Series.*

537. Klaus Deininger and Lyn Squire. "Measuring Income Inequality: A New Data-base." May 1996. 22pp. *Conference Paper Series.*

536. William Easterly and Ross Levine. "Africa's Growth Tragedy: Policies and Ethnic Divisions. May 1996. 33pp. *Conference Paper Series.*

535. Martin L. Weitzman. "Recombinant Growth." May 1996. 29pp. *Conference Paper Series.*

534. Francesco Caselli and Jaume Ventura. "A Representative Consumer Theory of Distribution." May 1996. 36pp. *Conference Paper Series.*

533. Michael Kremer. "A Mechanism for Encouraging Innovation." May 1996. 44pp. *Conference Paper Series.*

532a. Nirupam Bajpai and Jeffrey D. Sachs. "India's Economic Reforms: Some Lessons from East Asia." July 1996. 19 pp.

532. Nirupam Bajpai and Jeffrey D. Sachs. "India's Economic Reforms: The Steps Ahead." May 1996. 19 pp.

A complete list of the Institute's publications and the abstracts of papers that have been published after January 1995 can be viewed on the World Wide Web, at http://www.hiid.harvard.edu

To order DDPs, contact the HIID Publications Office, at (617) 495-3287.